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DIRECTOR OF OPERATIONS

PART I

Concept Paper for Weather Support to Air Force
Theater Operations

1995 - 2005

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SECTION 1. INTRODUCTION: MILITARY STRATEGY

1.1 PURPOSE. This document presents a weather support concept for theater operations consistent with United States Air Force military strategy and doctrine for the 10 years beyond 1995. While the support concept draws heavily from the combat weather support employed during Operation JUST CAUSE and DESERT SHIELD/DESERT STORM, the concept itself is built on general principles of support to theater forces, and therefore, is broad enough to apply to any future battlefield. This document is not meant to be directive in nature. Rather the document is intended to give guidance to planners and resource managers as they look to future weather equipment, personnel, and training needs. This document is a snapshot in time of customer weather support requirements. Our goal is to revise the document in concert with changes in customer requirements. However, there is always the danger that the document can become quickly out-of-date with the Air Force's weather support needs. Therefore, it is important that the Air Force weather community stay closely in-tune with their customers and be flexible enough to respond aggressively to changing customer requirements.

1.2 CONSTRAINTS AND ASSUMPTIONS. US military forces must be capable of meeting a variety of combat situations and challenges into the next century. Our forces may fight on a sophisticated battlefield with an existing communications infrastructure and logistics facilities, or they may have to fight from bare bases with only equipment which can be rapidly deployed via airlift into a theater of operations. We must be prepared to fight in every kind of climatic condition, from desert heat to arctic cold. Potential adversaries will range in capability from heavy forces equipped with sophisticated weapons to light, mobile, and well equipped terrorist and insurgent groups. The combined application of air-land-sea forces will require increased interoperability of all military services.

The US will rely less on permanent forward basing of forces, and more on rapidly deploying sufficient force to supplement our smaller in-theater "forward presence" forces. Some operations will be handled by air power alone, while others will require the combined firepower of air, land, and sea forces. The key to success will be the flexibility and worldwide reach of air power. Once engaged, we will fight the enemy in-depth using our ability to concentrate firepower and maneuver forces quickly to exploit enemy weaknesses. Operations will be rapid, unpredictable, violent, and disorienting to the enemy. The pace must be fast enough to prevent the enemy from taking effective counter-measures. **Weather** support forces must be organized, manned, equipped, and **trained** to deploy **on short notice to support this** concept of high mobility, high **intensity** warfare.

1.3 RECENT DEVELOPMENTS. The rapid changes in the Soviet Union political structures, the disintegration of the Warsaw Pact, the democratization of Eastern Europe, and the constant friction of Middle East politics present formidable challenges for US military planners. There is no way to accurately assess when **and** where the next international crisis **will** occur which will require US military intervention.

The change in the threat to US forces has caused a shift in emphasis from confronting Soviet, or Soviet-backed, forces to facing regional military powers who may threaten US vital interests throughout the world. However, budget constraints dictate a smaller, continental-based US military force which will be even more dependent on heavy airlift and fast **sealift** in order to react to worldwide contingencies.

1.4 FUTURE FOCUS. The weather Concept of Operations (CONOPS) described here focuses on the proposed warfighting doctrine and plans of the supported commander. Emphasis for planned capabilities has shifted from fixed field sites with well-established infrastructures to an operational concept emphasizing flexibility, mobility, autonomy, reliability, maintainability, and survivability. Additionally, the dynamic nature of war, with its attendant requirement to be able to change Air Tasking Order (**ATO**) allocations on very short notice, forces the entire ATO support process towards automation.

This weather CONOPS uses the same threat analysis as used in the Services' strategic planning cycle. Recent threat analyses move **the** planning focus from global confrontation to regional **crisis** and low intensity conflict.

The weather support requirements are derived from Air Force evolving combat doctrine, force structure, deployment procedures, and employment tactics. The weather concept of operations follows directly from statements of support requirements. Issues of timeliness, accuracy, frequency, and the kinds of products needed are essential ingredients in any CONOPS. The following sections apply these general concepts to specific types of forces and operations. Section 2 looks at general deployment and employment concepts, while Section 3 details the overall theater CONOPS. Section 4 discusses CONOPS for Air Mobility Command (AMC) and Special Operation Forces (SOF) "stand-alone" activities outside a well-defined theater.

SECTION 2. DEPLOYMENT AND EMPLOYMENT-CONCEPTS

2.1 THEATER AIR OPERATIONS. Current plans call for in-theater forces and/or an Air Combat **Command** (ACC) deployment to start with "the leading-edge" or "first-in" force: a highly mobile, self-contained, and potent fighting force. The core of this force could be one or more composite wings, and/or groupings of objective wings with specially trained functions (e.g., air superiority, etc.). The ultimate mix of forces will depend upon the national military strategy, the threat, and the military objective for the mission. The leading-edge force will deploy within hours of notification and will be able to maintain itself in the field, down to and including bare base operations, for at least 30 days. The leading-edge force will have to carry all necessary equipment and supplies using a very limited number of intertheater airlift assets. Planners must assume the leading-edge force will engage the enemy almost immediately upon arrival, and therefore, weather teams should prepare for operational weather support as soon as possible upon arrival.

If necessary, follow-on forces, including additional expendables/spares, will arrive by airlift during the transition phase (**C+30** to **C+60** days) and by both airlift and **sealift** during the sustainment phase (**C+60** days and later). The phased approach is designed to bring more capable observing, analysis, and forecasting equipment in order to add the technology needed for long-term battlefield support, and supplement the limited first-in capability which was size and weight constrained.

2.2 IN-THEATER AIR FORCES. USAF combat forces plan to automate the weather inputs to the mission **planning** cycle at all decision levels. A key element of the process is the ingest of the weather forecasts in the form of uniform gridded data fields (**UGDFs**), vector graphics, and alphanumeric data (to include formatted binary data) into the theater air component's command and control (C2) system. The data feed format, software, and hardware must be compatible with existing and planned **theater-** and unit-level automated systems, i.e. the Contingency Tactical Air Control System Automated Planning System (CTAPS), the Air Force Wing Command and Control System (AFWCCS) and the Air Force Mission Support System (AFMSS). The first priority for the data feed should be automation; however, systems should also have the capability for manual data input.

The air component level Staff Weather Officer (SWO) tailors the available **mid-** and long-range data to assist decision makers with the ATO apportionment and allocation process. The Air Control Center uses these same automated forecast products to build the **ATO**, assigning sorties to a designated target with a specific time over target. At the wing level, each flying unit

headquarters establishes a Wing Operations Center (WOC). The WOC translates the **ATOs** and Air Tasking Messages (**ATMs**), which are the mechanism for Army Corps to request offensive air support (i.e., close air support, air interdiction/battlefield air interdiction, electronic warfare) into specific squadron tasks and mission plans.

The CTAPS will provide the theater Air Forces component commander an automated capability to supervise the activities of assigned or attached forces and to monitor the actions of both enemy and friendly forces. **CTAPS** will display weather information necessary to aid in building the **ATO** and to support the monitoring/adjustment of current operations. This weather information includes databases for the entire area of operations for time periods long enough to surround the **ATO** planning cycle. These databases include information for development of both conventional and electro-optical tactical decision aids (**CTDAs** and **EOTDAs**) for weapons feasibility decisions, as well as briefing products that outline those regions of the area of operations where weather conditions could impact both air and ground operations. The CTAPS will receive the weather databases through a fully integrated weather work station. For execution of the **ATO**, the weather databases will be passed to **AFWCCS** along with the **ATO** which it supports.

-- The **AFWCCS** will provide **WOCs** with an automated capability to provide greater timeliness, accuracy, and security over the current (primarily manual) weather data display methods; Air Force Special Operations Forces will have different automated capabilities which are described in Sections 3.6 and 4.2. **AFWCCS** will display forecast information for selected targets; distribute local and alternate/divert airfield observations and forecasts; pass weather watches and warnings to all **AFWCCS** users. It will also allow wing-level planners to run **EOTDAs** and **CTDAs** for planning and execution forecasts. The **AFWCCS** will receive **UGDFs** and other weather data through a fully integrated weather work station which acts as the gateway to **AFWCCS**.

After the flying squadrons receive their mission taskings from the WOC, detached mission planning is done at the Squadron Operations Center (**SqOC**). The squadron staff works with **aircrews** to plan the execution of assigned missions. Crews will use the **AFMSS** to rapidly complete the mission planning process. The **AFMSS** will merge execution weather forecast products obtained from the **AFWCCS** local area network with intelligence, terrain, and other essential mission planning data. **AFMSS** will allow pilots to run automated execution **EOTDAs** and **CTDAs** to help them plan the best axis of attack and weapons release points. In the automated process, pilots will only contact weather forecasters if they need information not accessible from the weather data bases on **AFWCCS**. Weather forecasters will maintain and modify the weather data bases from the **AFWCCS** weather work station.

2.3 INTERTHEATER/INTRATHEATER AIRLIFT. Intertheater airlift forces (airlift, tanker and Civil Reserve Air Fleet (**CRAF**) aircraft) will be primarily CONUS-based, and will be responsible for the rapid movement of people and equipment into a theater of operations. Normally intertheater airlift forces will operate from established airfields along the flow route or use the traditional Deployed Tanker Airlift Control Center/Tanker Airlift Control Element (DTACC/TALCE) operations concept to make an airfield **suitable for** operations along the flow route or as a first-in capability in theater. While the DTACC is usually located at the same base with the Air Force component headquarters, they are usually in different facilities and require their own equipment. Weather support to intertheater airlift forces must be flexible enough to provide for operations for an DTACC/TALCE first-in capability until the base Wing Operations Center (WOC) is established with theater weather teams.

Intratheater airlift involves moving people and equipment to all echelons within the area of operations (AO). These operations would involve not only typical resupply missions to all areas within the area of operations, but combat operations in hostile areas on or behind the forward line of own troops (FLOT). Usually, intratheater airlift operates from established intratheater airfields with supporting weather teams. In those cases where there is no available airfield weather support, or if supplemental weather forecasters are needed, **TALCE** weather teams would be used to meet weather support requirements.

SECTION 3. CONCEPT FOR WEATHER SUPPORT TO THEATER AIR FORCE OPERATIONS

3.1 THEATER AIR FORCES. Major Command (**MAJCOM**) Directors of Weather will plan and tailor their operational support based on the stated requirements of the theater **CINC**, and this support should be consistent with existing service doctrine. Weather personnel at **MAJCOMs** and wing level need to work closely with their logistics counterparts to ensure weather equipment is included in unit deployment plans. The key to success in future theater air operations is following the precepts of flexibility, mobility, autonomy, reliability, maintainability, and survivability. These precepts dictate that future tactical weather equipment be modular and of a size and weight that is two-person portable, and has the robust communications needed to interface with customer's C2 systems and to network with other in-theater weather units. Interoperability with theater weather systems of our sister services is essential to provide the joint task force warfighter the capability to select the weather information he needs and display it **as** he chooses. The warfighter needs a comprehensive, real time picture of the battlefield and the ability to order, respond, and coordinate horizontally and vertically to the degree necessary to successfully execute the assigned mission.

The primary goal of theater weather support is to provide accurate and timely observations and forecasts to help ensure successful battlefield operations both in the air and on the ground. Accurate and timely weather products are force multipliers which enhance mission effectiveness. The sophistication of precision guided munitions (**PGM**) and the pace of operations on the battlefield require an increased number of observation locations on both sides of the FLOT, and increased frequency of observations. These observations are essential in the creation of accurate and realistic forecasts. Additionally, weather products must be more accurate and tailored to improve pilots' situational awareness of the battlefield.

3.2 LEADING-EDGE CONOPS. The leading edge, or first-in, theater weather teams will provide essential weather data necessary to enable the customer to put more bombs on target while enhancing safety and survivability from the onset of the conflict. These first-in weather teams will provide the foundation upon which long-term sustainment will be built. Therefore, the weather concept must use a modular building block approach. The equipment used by the first-in weather forces will be the baseline upon which the integrated, interoperable, intratheater weather support capability will grow.

Table 3.1 is a list of some of the products needed to support USAF combat forces at various decision levels. In the table, the bracketed (W) means the product is produced by wing level weather resources, and the symbol (T) refers to products generated at a theater weather center (TWC). The exact location and nature of the TWC is discussed in Section 3.2.5.

It is important to understand that this CONOPS is built from the bottom up as identified in Table 3.1. The size of the weather support force package for wing-level support is generally standard. Weather support resources devoted to decision levels above wing, however, are dictated by the overall size of the operation. For example, DESERT SHIELD/STORM employed a sophisticated in-theater command and control (C2) network, whereas JUST CAUSE used a much simpler **air** component **C2** system because of the limited air assets used during the contingency.

Prior to deployment, **SWOs** will notify Air Force Global Weather Central (AFGWC) at Offutt AFB NE, **or** one of the overseas theater forecast units to generate theater-specific forecast products in support of an Operations Plan or **a** time sensitive contingency plan. Communications requirements are specified in Section 3.2.7.

Immediately upon arrival in theater, the first-in weather team will: (1) provide observations/forecasts/watches/warnings in support of **airbase** operations: and (2) prepare tailored forecasts for specific combat missions against enemy targets. Each function requires a unique set of weather observations, and forecasting products and timelines as discussed below.

TABLE 3.1 EXAMPLE WEATHER REQUIREMENTS

Combat Air Forces (CAF)

a. Force Level (Mission Apportionment):

- O-72 hour forecast over AO (possible outlooks to 14 days) (T)
- UGDFs (T)
- ceilings/cloud layers/cloud bases and tops (T)
- visibility (T)
- chemical downwind message (CDM)/effective downwind message (EDM) (T)
- weather hazards in AO (T)
- broad area "stoplight" (red/yellow/green) weapon-specific EOTDAs and CTDA's (T)
- climatology
- meteorological satellite (METSAT) imagery covering the AO

b. Air Control Center Combat Plans (ATO Preparation and Dissemination)/DTACC:

- O-48 hour forecast over AO (Outlooks to 4 days) (T)
- UGDFs (T)
- ceilings/cloud layers/cloud bases and tops (T)
- visibility (T)
- CDM/EDM (T)
- hazards (T)
- broad area "stoplight" weapon-specific EOTDAs and CTDA's (T)
- air refueling track forecasts (T)
- climatology
- METSAT imagery covering the AO

c. Air Control Center Combat Operations (ATO Execution Management)/Air Support Operations Center (ASOC)/Modular Control Equipment (MCE)/DTACC:

- Weather observations from the AO (T)
- O-12 hour forecast over the AO (W)
- UGDFs (T)
- ceilings/cloud layers/cloud bases and tops (W)
- visibility (W)
- CDM/EDM (T)
- hazards (W)
- broad area "stoplight" weapon-specific EOTDAs and CTDA's (T)
- air refueling track forecasts (T)
- METSAT imagery covering the AO

d. Wing Level

- 0-24 hour forecast over AO (possible - 2 day outlook) (W)
- UGDFs (W)
- ceilings/cloud layers/cloud bases and tops (W)
- visibility (W)
- CDM/EDM (W)
- hazards (W)
- broad area "stoplight" weapon-specific EOTDAs and CTDA's (W)
- mission-specific EOTDAs and CTDA's for mission execution (W)
- air refueling track forecasts (T)
- vertical wind profiles (T/W)
- D-values (W)
- climatology
- weather observations
- **METSAT** imagery

e. Squadron Level

- 0-12 hour forecast (W)
- Sortie-specific forecast (W)
 - UGDFs (T)
 - ceilings/cloud layers/cloud bases and tops (W)
 - visibility (W)
 - CDM/EDM (W)
 - hazards (W)
 - iterative mission-specific weapon-specific EOTDAs and CTDA's for mission execution (W)
 - air refueling track forecasts (T)
 - vertical wind profiles (T/W)
 - launch/recovery forecasts (W)
 - D-values (W)
- latest available weather observations
- **METSAT** imagery

- Notes:
1. UGDFs contain winds from surface to 40,000+ feet
 2. Climatology products are produced by the United States Air Force Environmental Technical Applications Center (USAF ETAC)
 3. **METSAT** imagery is produced by tactical terminals supporting each theater air force operating level

3.2.1 **AIRBASE OPERATIONS.** **Airbase** operations support requires a local observing capability for both runway operations and resource protection. Observing equipment will be lightweight, two-person portable (equipment components able to be hand-carried over short distances and off/on loaded from/to aircraft and ground transportation equipment), easy and quick to set-up and tear-down, and autonomous in its operation. It will provide automatic relay of sensed elements to the base level forecast unit and to aircraft, preferably from a low power output device. First-in observations will include cloud base/type/coverage, visibility, pressure, temperature, dew point, surface wind speed/direction, current weather conditions, and precipitation amounts. Certain observing capabilities, such as lightning detection within a specified radius of the deployed air base, and wind speed and direction from the surface up to altitudes pertinent to theater operations are a goal for the first-in weather observing system, but will become a requirement during the transition phase to sustainment. Any sensor suites should have a modular "plug-in/plug-out" sensor capability to allow additional sensor configurations depending on needs of the mission being supported.

Resource and personnel protection from severe weather events will rely on the available surface observing network and **METSAT** imagery during initial operations; this imagery includes real-time data smooth (RDS) quality Defense Meteorological Satellite Program (DMSP) data plus all available geostationary satellite data. The lightning detection systems added during the transition phase will enhance this support. The full complement of severe weather observation systems will allow forecasters to determine the intensity and potential threat posed by approaching weather systems.

Airbase forecast responsibilities include producing takeoff/recovery forecasts, issuing weather warnings and advisories meeting defined lead times, and passing CDM/EDM forecasts to the appropriate air base agencies. If centralized **CDM/EDM** forecasts are not available, the local forecaster will develop the required forecast elements and pass them to the appropriate agencies. The first-in forecasting hardware must be capable of manually entering more recent data and automatically adjusting and modifying centrally-generated **UGDFs** covering the operational area of the supported wing. These baseline **UGDF** forecasts will focus on the 12 to 24 hour planning cycle for base operations and sortie generation as well as a 24 to 48 hour general outlook for the deployed area of operations. Finally, the first-in weather applications software must be based on the most current operational software employed in the base weather station peacetime operations; the peacetime and wartime forecaster **software** capabilities should be identical.

Initially, AFGWC must provide all required central products until an in-theater TWC and a theater weather communications network are established. Until reliable communications become available or in the event they are lost, units will use climatological UGDFs, METSAT, and a limited set of AFGWC-generated forecast products. These products will be transmitted via a secondary broadcast such as the current High Frequency Regional Broadcast (HFRB) system as described in Section 3.2.7.1. When the in-theater TWC becomes activated, it will generate mesoscale forecast products for combat operations. These will be transmitted via the theater fixed, backbone communications network. If necessary, a special secondary broadcast, such as an HFRB transmission from AFGWC, will transmit products to meet the needs of those units not **physically located** within the theater, but participating in or supporting theater combat operations. AFGWC will also act as a backup in case the in-theater TWC fails or is destroyed by enemy actions. More details on the capabilities, products and responsibilities of the TWC are described in the Sections 3.2.5 and 3.2.6.

3.2.2 MISSION SPECIFIC SORTIE GENERATION WEATHER. Producing mission specific, detailed weather products for sortie generation and combat mission success will be challenging in the first-in environment. Obtaining detailed observations from the enemy-held side of the FLOT presents the most serious challenge of the next decade and must be addressed by the R&D community as part of an overall battlefield sensing strategy.

The collection of weather elements will depend on a mix of autonomous and man-operated systems. Ground-based sensors must be lightweight and two-person portable to allow rapid redeployment to support fluid battlefield operations. Furthermore, ground-based observing equipment positioned in enemy territory must be designed from the outset to be expendable, tamper-resistant, and must use approved protective communication techniques to ensure covertness, and not jeopardize life or equipment if recovery is attempted.

Observations from across the battlefield should be collected in-depth and transmitted in near real time, to appropriate battlefield users as the first link in forecast development. This includes observations from data-sparse areas on the friendly side of the FLOT. In coordination with the TWC, the theater commander's SWO will implement a sensing and data collection strategy for these observations. Observations could be obtained by dispersing a number of autonomous observing suites throughout the data sparse area and relaying their measurements to the TWC by any available intratheater communications network. The density of the observation network and the frequency of observations to be relayed is dependent on the mission, terrain, threat, and the time the mission forecasts are required. For

example, observations of winds, pressure, temperature, visibility, IR transmissivity, cloud heights, and cloud amounts are needed **in the** target area to determine how to employ both precision guided and conventional munitions. In addition, selected units will need to collect battlefield observations of winds and atmospheric stability to support air drop operations; if at all possible these observations should be sent to the TWC to support Nuclear/Biological/Chemical (NBC) dispersion forecasts. The TWC can then disseminate these observations to the appropriate wing-level units.

The complexity and frequency of observations required, combined with the short timelines in the decision process, demand that wing-level forecasting units have the hardware necessary to store, validate, and process all observations, as well as receive, store, adjust, and update forecast **UGDFs** from the TWC. The use of current ground-based and space-based observations to update the forecast fields poses a particularly difficult problem. On the battlefield, real-time observations are taken asynoptic in time (i.e., not at preset hours or on the hour) from randomly spaced locations. It is also likely these observations will cover only a small fraction of the overall AO.

Satellite measurements will continue to be a principal means of observing weather across the AO. First-in capability must include automated reception of RDS quality (visual and IR) imagery from the DMSP, any other visual and IR imagery from polar orbiters, as well as imagery from geostationary weather satellites; this requirement applies to both US-owned weather satellites and those satellites owned by other nations. This same satellite imagery capability must be resident at fixed installations (i.e., home base) because forecasters need to work and be familiar with the same types of data in peacetime they will use in wartime.

Satellite observations will be particularly useful to obtain important data within hostile territory. In all cases, observations must arrive at the TWC in time to be used in the forecast production cycle. This requirement will strain local communications capabilities early in the contingency when **AFGWC** is the **TWC**. Details of the communications network requirements are contained in Section 3.2.7.

Data from sensors aboard customer weapons systems and , unmanned air vehicles (**UAVs**) may also provide a source of critical weather information. In addition, target area weather information (TARWI) will prove invaluable for later forecasts on the same, or nearby target areas, as well as providing verification for target weather forecasts. The keys are: (1) a theater communication system capable of relaying these perishable observations to all battlefield decision levels, including the in-theater TWC, in a timely manner; (2) the ability of the

gaining weather units to fuse this data into weather products; and (3) the availability of intertheater secure communications to provide these classified observations as input to models run at AFGWC. Fusion of this TARWI, much of which will be classified, into the local weather database will be accomplished on the AFWCCS (classified) weather workstation.

At the wing level, data fusion of observations in time and space is the first step in building an execution forecast for both the ground and air war. This task is required at every wing-level forecasting unit, and it will use a computerized, regional-scale, - objective analysis procedure to update the UGDFs generated by the TWC. This updating procedure is an automated data analysis technique which smoothly merges real-time observations into the **UGDFs**. In addition, the analysis software will allow manual data modifications. The purpose of the modifications are to improve mission execution weather forecasts in and around the mission designated target areas.

This data fusion must be distinguished from the running of a dynamic mesoscale forecast model. The forecast model is run at the TWC and generates forecast products containing 6 to 48 hour forecast fields. On the other hand, the data fusion process allows the wing-level forecaster to update and modify the 12 to 24 hour forecast products with current observations, and correct the forecast products if necessary.

The purpose of any forecast is to clearly articulate operational impacts of current and forecast weather conditions to decision makers in time to influence the **course** of a battle. Today's sophisticated EO weapons are very sensitive to weather conditions that degrade electromagnetic propagation. EOTDAs characterize weather effects on EO weapons by estimating acquisition and lock-on ranges. CTDAs are traditional weather products such as cloud height, cloud cover, precipitation location and intensity, etc. that provide general guidance on the effectiveness of EO weapons systems.

AFMSS will automate the mission planning process and allow pilots to generate EOTDAs and CTDAs for their specific missions. It will make available all necessary weather data, including UGDFs for EOTDAs and CTDAs, en route weather conditions, divert and alternate airfield forecasts and horizontal weather displays to squadron level mission planners. The weather data will be available to AFMSS via the weather workstation on AFWCCS. **Wing-level** forecasters will be responsible for tailoring the UGDFs for specific target areas, and building horizontal weather depictions (**HWs**) on the AFWCCS **weather workstation**.

3.2.3 EQUIPMENT SIZE AND PACKAGING. All the observational and forecasting hardware for the first-in capability at wing level

must be loaded into standard Air Force two-person portable containers and loaded onto a single standard pallet for air transport. In addition to the hardware, the pallet must also contain a 30-day supply of spare parts and expendable items, so that there is no loss in capability due to equipment problems prior to the **arrival** of sustainment support items.

3.2.4 MAINTAINABILITY AND SUSTAINABILITY. Combat air organizations are moving towards a two-level maintenance concept for deployed operations. At the deployed base level, maintenance will consist largely of simple card/part replacement. At the theater level, a Command Supported Systems Center (CSSC) will be established at about the 30-day point to provide in-depth maintenance support.

Tactical weather equipment should be neither more nor less maintainable and sustainable than supported customer C2 systems. Tactical weather equipment should therefore meet the following standards established as goals by the **CAF**:

- a. Mean time between critical failure (MTBCF): 6833 hours
- b. Mean time between failure (MTBF): 720 hours
- c. Mean time to repair (MTTR): 15 minutes
- d. Mean down time (MDT): 30 minutes
- e. Operational availability (OA): 99.95 percent
- f. **Capability** to fault, diagnose, identify, report and isolate to an assembly, module, and single circuit card assembly (CCA) 98 percent of all failures without using external test equipment or tools.

For extended operations during the sustainment phase of a contingency, **SWOs** will arrange for resupply for deployed equipment and Readiness Spares Kit (RSK) through CINC resupply channels. This resupply concept should mirror that for other functional **areas** supporting the CINC.

3.2.5 CENTRALIZED WEATHER SUPPORT. In those theaters without an existing forecast unit, AFGWC must act as the TWC for the first-in units until the in-theater TWC and weather communications network is established. Establishing the in-theater **TWC** is the first step in transitioning to the sustainment phase of the operations, if necessary. **AFGWC/TWC** products will include short-, mid-, and long-range forecasts for both in-theater weather and weather at embarkation and debarkation ports and airfields. As the **TWC, AFGWC** will require

robust two-way secure communications with theater weather assets. This includes ingesting theater **observations** into the AFGWC forecasting process and being responsive to product changes/additions dictated by changing mission requirements. The two-way secure communication will include computer-to-computer interface to allow easy access of graphic displays of forecast products.-

After the in-theater TWC comes on-line, AFGWC will cease generation of products for wing-level support unless specifically requested by the in-theater **TWC**. In such instances, **AFGWC** must follow the forecast guidance in the Joint Operations **Area Forecast (JOAF)** issued by the in-theater TWC. AFGWC will, however, maintain the ability to pick up **TWC** responsibilities on short notice, in case the in-theater **TWC** becomes incapacitated. Therefore, AFGWC will play a crucial interactive role throughout the time weather units are in the theater of operations. Once the in-theater TWC is established, it will closely work with AFGWC to coordinate forecast products and specialized mission support. AFGWC will continue to provide tailored products for those regions outside of the **TWC's AO** for use by forces supporting or conducting combat operations which are not based in the AO. **AFGWC** will ensure these products follow guidance contained in the in-theater **TWC's** products.

The Air Force Space Forecast Center (**AFSFC**) will be tasked to provide forecasts to enhance HF frequency management of the in-theater HF network or other HF systems such as the **HFRB** system. In addition, AFSFC will provide forecasts of ionospheric scintillation which may disrupt or degrade in-theater satellite communications (SATCOM). At such times, the in-theater weather RF network will become the primary weather communications network. **AFSFC** will also provide alerts and warnings of solar/geophysical events that will disrupt or degrade HF or SATCOM communications.

USAFETAC will be tasked to provide climatological products for theater weather support. Most of these products will be pre-positioned for deployment with first-in weather teams, but USAFETAC must be responsive to requests for additional climatological products.

3.2.6 C2 THEATER WEATHER. The size of the deploying package and the type of command and control structure will determine the weather support required in the AO. In all cases, the number one job is direct combat weather support. The weather products required for mission execution, however, differ substantially from those required at other levels of decision making from force apportionment down to mission planning.

The types of weather support needed involve not only the obvious distinctions between short-, mid-, and long-range

forecasts, but also differences in spatial extent and resolution, as well as the depth of the atmosphere considered. For example, at the unified command level, the decision maker is most concerned about the portion of forces assigned to specific mission areas. However, to do this planning correctly, the decision maker needs to know the weather forecasts (short, mid, and long range) at both the embarkation and debarkation ports which may be thousands of miles apart. In addition, en route flying weather for strategic airlift could be at a completely different range of altitudes than those intratheater forces are using. Local weather conditions along the inter- and intratheater transportation routes will impact the supply of personnel and material. Therefore, each decision level has unique weather requirements which need different weather support products. The product matrix shown in Table 3.1 illustrates the diversity of products required.

As discussed in Section 3.2.5, **AFGWC** will be the **TWC** for the first-in support, and will be activated upon notification of the initial deployment. **AFGWC** will remain the primary **TWC** until the in-theater **TWC** is activated. Establishment of the in-theater **TWC** is the first phase of attaining a long-term sustainment capability and will generally occur about 15 to 30 days into the operation. The in-theater **TWC** should be collocated with the highest level decision maker (e.g., Joint Forces Commander or Theater CINC).

During the first-in phase, the **AFGWC/TWC** forecast products will be distributed to all decision levels. Long-range forecasts (3 to 14 days) will be sent automatically to the joint and component level **SWOs** via any available communications; the long-range forecasts will provide planning guidance for initial allocation and attack decisions. Other weather products will be produced by the deployed weather teams using weather algorithms resident on customer C2 systems. For example, for short-term planning (0-72 hours), a simplified version of the EOTDA will be run to determine if weather conditions over the target areas are generally good, bad, or marginal for the employment of **PGMs**. Depending on the package size deployed, the force level command center may or may not be in-theater.

The senior weather officer in-theater should be the **SWO** to the theater commander. The **SWO** to the theater CINC, should deploy forward when that commander's main staff element deploys, at which time that individual assumes the role of the senior weather officer in-theater. This individual would then be responsible for integrating component weather assets and for incorporating the **TWC** into his/her operation. The **TWC** staff would normally be composed of meteorological and oceanographic personnel from those services making up the JTF or the theater commander's staff.

The-Air Control Center needs **weather** support to assist the translation of mission allocation direction into detailed plans for the execution of the **ATO**. The **ATO** is issued daily, usually for the next day's 24-hour period, tasking assigned/attached units to specific missions. Weather forecasts for **airbase**, en route, and targeting weather will be stored in the Air Control Center's **ATO** generation system for use in the **ATO** building process. Upon execution of the **ATO**, the Air Control Center function includes monitoring in-progress operations, mission status, mission effectiveness, and issuing directives to adjust current operations including immediate attack/reattack using alert aircraft or diverting aircraft already airborne. The plan is to use 48-hour forecast products, prepared by the TWC, to support the **ATO** building process. Automated weather **TDAs**, both E-O and conventional, will produce go/no-go guidance based on customer defined thresholds that focus on impacts to mission executions, and not sortie tactics. At the Air Control Center level, decision makers want to know if weather will seriously impact or prevent the employment of **PGMs** (go/no-go) over specific targets, and not particular details like acquisition and lock-on ranges. The Air Control Center staff also needs to be kept informed, using such products as **METSAT** imagery, of current weather conditions over target areas for missions currently being executed. This will **allow** for last minute changes in mission execution, based on **weather** conditions, and should improve mission effectiveness.

3.2.7 FIRST-IN COMMUNICATION NETWORK. Communications have been **and** will continue to be constrained for in-theater weather operations. This CONOPS calls for a broadcast capability from AFGWC direct to deployed units. The component levels would also **have** two-way communication to AFGWC for receipt of special **product** requests and transmission of **AO** observations and forecasts.

Leading-edge weather communications must incorporate and support the application of the warfighting precepts of flexibility, mobility, autonomy, reliability, and survivability. For example, weather communications equipment size and weight must be minimized to fit the limited space allotted in leading-edge deployment equipment loads. War plans must include the deployment of initial communications equipment, but must also retain the flexibility to take advantage of in-place weather communications infrastructure where it exists. Since the planning process is very situation dependent, this concept considers a bare-base worst case scenario and describes communications capability deployed into a theater of operations.

ACC has identified a set of leading-edge theater air base weather product requirements and the communications capabilities needed to satisfy these requirements. A high-level illustration

of the first-in weather communications requirement is shown in Figure 3.1.

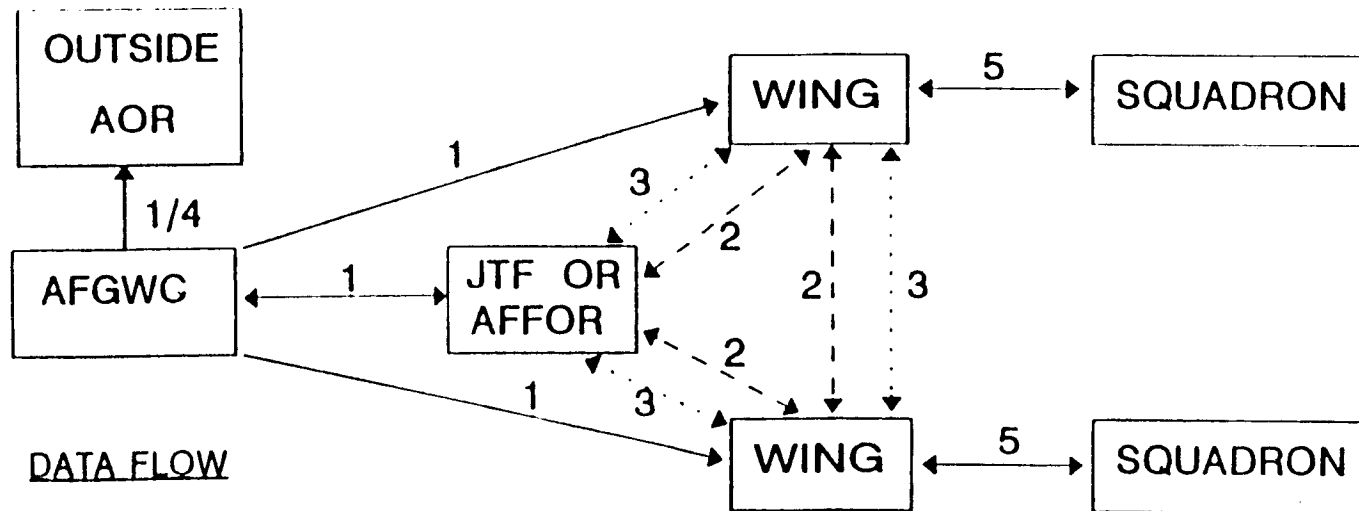
3.2.7.1 HF BACKUP. As mentioned earlier, during first-in operations all **AFGWC/TWC** products will be broadcast in-theater via a **SATCOM-like** system with a special secondary broadcast system (e.g. **HFRB**) product as backup. If TWC connectivity is unavailable or is lost, the first-in wing-level unit will be forced to go to HF backup.

Each wing-level unit will use precomputed **climatological** UGDFs resident on their forecast hardware when forced into the HF backup mode. These climatological UGDFs **can** be modified using the normal objective analysis tools described in section 3.2.2; the standard secondary HF broadcast (e.g. **HFRB**) graphics charts will be used as guidance in the adjusting ("bogusing") process. These precomputed climatological UGDFs will be loaded on a hard disk and will become part of the normal electronic Wing Weather Officer/Staff Weather Officer (**WWO/SWO**) kit built to support a unit's specific theater tasking (analogous to the hardcopy **climatologies** carried in **WWO/SWO** kits in the past). In order to help the forecaster select the most useful climatology for a given day, the TWC will compare **all available theater** climatological UGDFs with the latest output from the dynamic forecast model. A designator indicating which theater climatological UGDF most closely fit the actual forecast weather will be included **as a new** product in the secondary HF (e.g. **HFRB**) broadcast.

As a potential secondary weather broadcast system solution, the HFRB would have two components: (1) fixed sites broadcasting AFGWC products in peacetime and wartime; and (2) a portable system which can be readily deployed if the current fixed site network cannot reach the **AO**. Current technology will allow the HFRB capability to be packaged in two-person portable containers which will easily fit onto one standard Air Force pallet for airlift. This portable system will link-up to AFGWC by either a SATCOM-like **system** and/or "hardwire" depending **on available** resources and the area to be covered. The portable system should be completely automated including changing the broadcast frequency via message from AFGWC.

Within the theater, **the** HF network will be the primary link between **wing-level** units to pass local observations and to provide "buddy-station" backup if a wing-level unit's forecasting hardware should fail. Once in-theater, every wing-level unit will have **HF** equipment with- an automatic link establishment capability to maintain network connectivity. The highest component command level unit in-theater will become the network control station (NCS) establishing specific broadcast sequence and times for every wing-level unit on the weather HF net. At

FIRST-IN DATA FLOW



DATA FLOW

- 1 - AFGWC FIRST-IN PACKAGE (UGDF/VG/FBD)
- 2 - AOR WX NET PACKAGE (OBS/FCST)
- 3 - C2 NET PACKAGE
 - INITIALLY SAME AS PACKAGE 2
 - EVOLVES TO COMBINATION OF PACKAGES 1 AND 2 AS C2 NET MATURES
- 4 - AFGWC PRODUCTS FOR REGION OUTSIDE OF AOR
- 5 - TAILORED UGDFs/PRODUCTS AND PIRPS/TARWI

Fig 3.1

least one unit deploying in-theater (preferably the NCS) needs to carry a lightweight, portable, low power (a few watts), automated ionospheric sounder whose data will allow **AFSFC** to identify optimum transmission frequency for maximum network connectivity. Soundings will be taken and processed hourly by the sounder. The ionospheric sounder needs to be small enough to fit in a single two-person portable container. The low power output of the sounder is needed to minimize any broadcast signature.

3.3 SUSTAINMENT CONOPS. The sustainment phase of the theater operations concentrates on the period **C+60** and beyond, at which time **sealift** is bringing in heavier, more capable equipment and additional supplies. The transition phase (**C+31** to **C+60**) is a sequenced growth plan building up to the sustainment phase. At least for fixed base support, the transition to full sustainment will be rather simple and can be accomplished whenever the necessary hardware elements arrive in-theater.

The most important added capability "ramping up" to the sustainment phase is a fully operational, in-theater **TWC** collocated with the Theater CINC. The in-theater **TWC** will take advantage of the in-theater backbone communications network established as part of the in-theater sustainment plan. Once the backbone communication is in place, the **TWC** will have access to DDN and increased SATCOM-like systems. In addition, the in-theater weather network can transition from HF to using the backbone dedicated communications network. Once the transition is completed, the first-in HF weather net will become a "hot backup."* Weather communication requirements for the sustainment phase are contained in Section 3.3.1.

The in-theater **TWC** will be capable of running the dynamic mesoscale forecast model for the entire AO. **Effective** execution of this model will require that the in-theater **TWC** receive all theater weather observations including very high resolution DMSP imagery (IR and visual) and all DMSP mission sensor data, as well as all civilian polar and geostationary satellite imagery. The **TWC** weather products will be distributed via customer communication channels to all decision levels in theater. The purpose and complexity of the **TWC** products will remain the same as described in the first-in capability. The only difference is the products are now generated by an in-theater weather asset rather than **AFGWC**. As described in Section 3.2.5, **AFGWC** will continue to operate in a "shadow mode" to act as a hot backup for the in-theater **TWC** and also to support out-of-theater assets who need weather products for mission planning. In the latter case, **AFGWC** will follow the guidance contained in the in-theater **TWC** products to ensure forecast consistency.

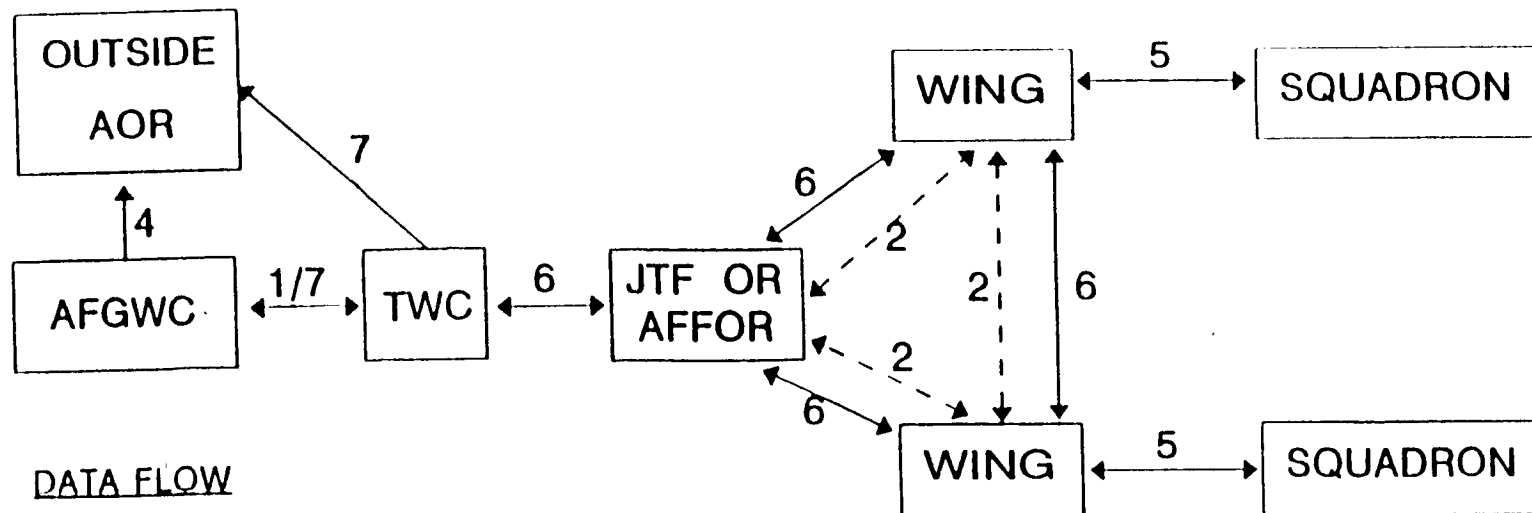
At the wing level, the enhancements during the sustainment phase will include the ability to receive DMSP very high resolution imagery (0.3 nm), both visual and IR, and all mission sensor data as well. Other enhancements include instrumenting both ends of every active runway with the automated **observing** equipment. Based on the needs of the **TWC**, certain units may be tasked to take upper air wind profiles to the tropopause. Additionally, tactical weather radars with severe weather detection capability will be employed at selected locations which are far enough away from the FLOT to permit active sensing. As mentioned above, the communication connectivity between **wing-** level weather units will transition from the first-in HF net to using the in-theater backbone communications network.

Mission specific weather support will remain virtually unchanged during the sustainment phase. The addition of the very high resolution DMSP and mission sensor **data will improve a** forecaster's ability to tailor the forecast **UGDFs** to meet mission objectives and requirements. In addition, as ground forces move into areas previously controlled by enemy forces, new automated observing sites can be established to add depth to the observing network.

3.3.1 SUSTAINING COMMUNICATIONS. ACC identified a set of sustaining theater air base weather product requirements and capabilities. A high-level illustration of the sustaining weather communications capability is shown in Figure 3.2. Sustaining communications capability differs from leading-edge capability in the increased use of **"hardwire"** communications modes during the sustaining phase of the contingency. These communications will be predominately shared, rather than dedicated weather information-only channels or lines. Weather units will transition to "common user" in-theater communications systems (e.g., a component's DDN system) to send observations, forecasts and watch/warning information to the component headquarters WETM for subsequent relay in and out of theater. However, **AO** HF communications will remain available during the sustaining phase, at least in the early years, as a backup when "hardwire" communications fail or **as** primary capability where "hardwire" communications are not in place.

3.4 LONG-RANGE **COMBAT** MISSION SUPPORT. Under the "Global Reach/Global Power" doctrine, long-range CONUS-launched missions are options for one-time strikes or for immediate response prior to any deployment. Although weather teams will not be in theater in these circumstances, missions of this type will require en route, theater and target weather information. The **SWO** supporting these missions will notify AFGWC and/or an overseas theater forecast unit to generate specific weather products in support of the operation. These products will be transmitted to

POST-TWC ACTIVATION DATA FLOW



DATA FLOW

- 1 - AFGWC SUPPORT PACKAGE
(VG/FBD/MODEL INITIALIZATION)
- 2 - AOR WX NET PACKAGE
(OBS/FCST)
- 4 - AFGWC PRODUCTS FOR REGION
OUTSIDE OF AOR
- 5 - TAILORED UGDFs/PRODUCTS AND PIREPS/TARWI
- 6 - SUSTAINMENT C2 NET PACKAGE
- 7 - TWC PRODUCTS

Fig 3.2

weather teams supporting tasked units for use in mission planning, execution, flight following, and mission redirection, if needed.

3.5 AIR MOBILITY WEATHER SUPPORT. This portion of the **CONOPs** addresses the special weather support requirements for tanker/airlift operations. This section assumes the in-theater Air Force infrastructure described in Sections 3.1 to 3.3 exists. Stand-alone operations for air mobility forces are discussed in Section 4.

3.5.1 INTERTHEATER TANKER/AIRLIFT OPERATIONS. Intertheater mobility forces (airlift, tanker and **CRAF** aircraft), will be primarily CONUS-based and will be responsible for the rapid movement of people and equipment into a theater of operations. Critical weather parameters are those which serve to optimize airflow (i.e., en route winds, landing/take-off minimums, etc.). With the procurement of new aircraft (C-17) and the concept of direct delivery, increased emphasis will be placed on threat avoidance through the use of tailored **EOTDAs** and **CTDAs** when arriving within theater.

Normally, intertheater mobility forces will operate from established airfields along the flow route or use the traditional **DTACC/TALCE** operations concept to make an airfield suitable for operations along the flow route or as a first-in capability in theater. While the DTACC is usually located at the same base with the Air Force component headquarters, they are usually in different facilities and require their own equipment. Weather support to intertheater mobility forces must be flexible enough to provide for operations for a **DTACC/TALCE** first-in until the bare-base WOC is established with theater weather teams. At such time, the **DTACC/TALCE** weather team will turn over observation, forecast and resource protection responsibility to the theater weather team. The **DTACC/TALCE**, including weather teams, would be free to relocate and establish another operation elsewhere. A theater weather team at a bare base must have its own sustaining weather equipment/communications when an **DTACC/TALCE** weather team moves. **DTACC/TALCE** weather team observations will include cloud base/type/coverage, visibility, pressure, temperature, dew point, surface wind speed/direction, and current weather conditions. Resource and personnel protection will rely upon severe weather observations from **AMC** weather **observers/weather** satellite data and available indigenous capabilities. **Airbase** forecast responsibilities include producing takeoff/landing forecasts and issuing weather warnings/advisories/watches meeting defined lead times. The first-in computer software must be based on the current version of the operational software employed in the peacetime base weather station operations.

3.5.1.1 OBSERVING/FORECASTING/COMMUNICATIONS. Observing, forecasting, and communications equipment requirements are the same as in Sections 3.2.1 and 3.2.2 for a first-in capability. Centralized weather support products **for** the deployed DTACC/TALCE will initially be provided by AFGWC until the TWC is up and running. Intertheater weather information on ports of embarkation (**POEs**), intermediate staging bases (**ISBs**), flow air routes, and alternate airfields must be included/consolidated by **AFGWC/TWC** in theater products for **DTACC/TALCE** use. In addition to the theater communication network already outlined in Section 3.2.7 (First-In) and 3.3.1 (Sustainment), the AMC TACC weather support unit will transmit Air Refueling Forecasts for intertheater missions via the AMC C2 communications network. During major, very high volume tanker/airlift operations, it may become necessary to establish a regularly-scheduled broadcast of theater weather data over the AMC HF command and control frequency. This procedure will allow airborne **aircrews** access to current weather information without tying up the HF radio network.

3.5.1.2 MAINTAINABILITY AND SUSTAINABILITY. The maintenance concept would be one of limited operator maintenance (card/circuit board replacement) primarily with enough critical spares (a RSK) to enable the observing/forecasting systems to operate for a minimum of 30 days using the system self-diagnostic capabilities. Inherent **DTACC/TALCE** maintainers will be used to the maximum extent to repair systems in the field. Any other maintenance would require a spare **flown in** to replace the failed item, which would be returned to the CSSC or depot for repair.

For extended operations during the sustainment phase of a contingency, **SWOs** will arrange for resupply for deployed **equipment** and RSK through CINC resupply **channels**. This resupply concept should mirror that for **other functional** areas supporting the CINC.

3.5.2 **INTRATHEATER** TANKER/AIRLIFT OPERATIONS. Intratheater weather support services are primarily concerned with observing, forecasting and **SWO** weather support to all echelons of operational mobility forces. These operations would involve not only typical resupply missions to all areas within the area of operations, but combat operations in hostile areas on or behind the FLOT. Weather support services would include a mix of conventional observing/forecasting services and unique weather support involving **EOTDAs** and **CTDAs** for threat avoidance and airdrop/rescue operations (i.e., paratrooper employment, pararescue operations, low altitude parachute extraction system/container delivery system (LAPES/CDS)-type drops, combat control team (CCT) employment, etc.). In general, provisions of sections 3.2.1, **airbase** operations and 3.2.2, mission specific

sortie generation weather, apply. Additional requirements include the following:

- a. Hazards to flight (especially turbulence, icing, thunderstorms during airdrop operations);
- b. Temperature/dew point temperature/pressure altitude (especially in calculating maximum loads);
- c. Mission specific **EOTDAs** (threat avoidance, night operations);
- d. Surface and drop altitude winds to include the wind profile between drop altitude and surface;
- e. Drop zone/assault zone/landing zone/extraction zone forecasts.

3.5.2.1 OBSERVING/FORECASTING/COMMUNICATIONS. Requirements are the same for first-in and follow-on capabilities as previously identified.

3.5.2.2 MAINTAINABILITY AND SUSTAINABILITY. The maintenance concept will be one of limited operator maintenance (card/circuit board replacement) primarily with enough critical spares (an RSK) to enable the observing/forecasting systems to operate for a minimum of 30 days. Any other maintenance would require a spare flown in to replace the failed item, which would be returned to the CSSC or depot for repair.

For extended operations during the sustainment phase of a contingency, **SWOs** will arrange for resupply for deployed equipment and RSK through CINC resupply channels. This resupply concept should mirror that for other functional areas supporting the CINC.

3.5.3 EQUIPMENT SIZE AND PACKAGING. All weather/communications equipment for a first-in capability including RSK spares and a 30-day supply of expendables for the **DTACC/TALCE** and intertheater tanker/airlift weather teams must fit in standard two-person portable containers occupying no more than one standard pallet. Using the modular concept, these weather teams would be able to mix and match weather/communications equipment according to operational mission requirements to meet their first-in capability. Additional required first-in weather/communications equipment could follow in subsequent airlift.

Intratheater airlift must address the sizing and packaging requirements of not only those listed above but the **CCTs** which

have a much more stringent requirement for weather observing equipment and a limited upper air measurement capability.

3.5.4. CENTRALIZED WEATHER SUPPORT. Initial AFGWC weather support products provide theater weather information until the **TWC** is up and running. AFGWC not only provides theater weather information but intertheater weather information to include **POE/ISB/alternate** observations/forecasts, en route hazards, etc., as well. Even when the in-theater **TWC** becomes operational, it will not provide intertheater weather products; that function will remain at AFGWC.

3.5.5 INTERTHEATER/INTRATHEATER WEATHER DEPENDENCY. Inherent in any theater operation is the requirement, both within and outside of the theater, for weather teams to have access to/freely exchange weather information. DESERT SHIELD/STORM proved theater **CINCs/supporting CINCs** and their staffs required weather information directly impacting the logistical tail (i.e., affecting air and sea routes). An even more critical requirement was at local level, where theater forecasters required weather information to brief **aircrews** to out of theater destinations. The reverse is also true; the forecaster out of the theater needs access to theater weather information to brief aircrews.

3.6 AIR FORCE SPECIAL OPERATIONS FORCES. Air Force Special Operations Forces' (AFSOF) strategy requires a "first-in" weather support capability. Its role is similar to that of "leading-edge" operations and dictates future tactical weather equipment be modular and of a size and weight that is two-person portable, interoperable with theater weather systems, and have the communications needed to interface with the customer's command and control systems and to network with other in-theater weather units.

Support to AFSOF operations may require dedicated weather support to a deployed Air Force Special Operations Command (AFSOC), one or more Air Force Special Operations Detachments (**AFSODs**), and Forward Operating Locations (**FOLs**).

AFSOC support from a deployed Special Operations Weather Team (SOWT) includes 24-hour/day SWO, mission planning and briefing support to the commander, staff and aircrews. The role (joint, unilateral, conventional) and location of the AFSOC will drive the type of weather support required. If the AFSOC deploys to a bare base without existing observing and forecasting capability, the SOWT will require additional forecasting and observing augmentation to provide that support.

The AFSOD SOWT will usually provide **SWO** support to flying

operations. When base weather station services are required but not available at the deployed location, the Theater Air Component **SWO** is responsible for providing additional observing and/or forecasting augmentation as required.

FOL support needs are normally handled remotely from the AFSOC or AFSOD locations using command and control communications only.

3.6.1 FIRST-IN CONOPS. These first-in **SOWTs** will provide the foundation upon which long term sustainment will be built and must also use a building block approach. The equipment used will be the baseline upon which the integrated, interoperable, intratheater weather support capacity will grow. Table 3.2 lists AFSOF weather product requirements.

AFSOF WEATHER REQUIREMENTS (TABLE 3.2)

AFSOC LEVEL:

- UGDF forecasts (possible input into AFMSS)
- Latest available weather observations from the **AO**
- 24-72 hour mission planning forecasts
- 12-24 hour **AO** en route/AZ forecasts
- 12-24 hour **AO** forecasts (possible 120 hour outlook)
 - Ceilings/cloud layers/cloud bases and tops/type
 - Visibility
 - Hazards
 - **TDAs** (Conventional, EO, **IREPS**, etc.)
 - Chemical downwind messages (CDM)
 - Wind speed and direction
 - Temperature/humidity
 - Vertical wind profiles
 - Take-off/landing forecasts
 - Alternate/recovery forecasts
 - Sea states, temperature, etc.
- Latest available **METSAT** imagery from **AO**
- Climatology

AFSOD LEVEL:

- Tailored theater UGDF forecasts (possible input into **AFMSS**)
- 24 hour forecast for resource protection (bare base)
- 12 hour **AO** forecasts
- 12-24 hour mission-specific forecasts (every 6 hours)
 - Ceilings/cloud layers/cloud bases and tops/type
 - Visibility
 - Hazards
 - **TDAs** (Conventional, EO, **IREPS**, etc.)
 - CDM
 - Wind speed/direction
 - Temperature/humidity
 - Vertical wind profiles
 - Take-off/landing forecasts
 - Alternate/recovery forecasts
 - Sea states, temperatures, etc.
- Latest available **METSAT** imagery from **AO**
- Climatology

Immediately upon arrival in-theater, the SOWT at the AFSOC level will provide tailored mission forecasts. Until such time as fixed connectivity allows for receipt of **UGDFs** from AFGWC, the SOWT will use its **METSAT** receiving capability, HF connectivity to other locations, a secondary broadcast system such as **HFRB**, and climatological data bases to provide other forecasts.

The AFSOD SOWT initially relies on HF receipt of AFSOC-tailored mission products, its own **METSAT** receiving capability, secondary broadcast system (e.g. **HFRB**) data receipt, climatological data bases, and local observations to provide needed support.

Weather support to **FOLs** is usually limited to remote weather briefings from AFSOC or the **AFSODs**. If operational missions are staged out of **FOLs**, observers and forecasters may be deployed to provide tailored mission support using customer communications only. Communications restrictions and/or mission sensitivities will drive this requirement.

Airfield support and mission planning/forecast support each require a unique set of weather observations, forecasting products, and timelines as discussed below. Table 3.3 identifies weather support capabilities needed at each level to support both first-in and sustainment operations.

3.6.1.1 **AIRBASE OPERATIONS.** If required, base weather station support will be provided by an augmented **SOWT**. Observing and forecasting equipment must be lightweight, man-portable, easy and quick to set-up and tear-down, autonomous in its operation, and provide automatic relays of observations to the AFSOC and, via theater Special Operations Command HQ, to AFGWC.

3.6.1.2 **MISSION-SPECIFIC PLANNING/FORECASTS.** Normally AFSOF forces deploy to locations which are already supported by other weather personnel (allied or indigenous). The host base weather function provides the official airfield observation and take-off/recovery forecasts. The **AFSOC/AFSOD** forecaster provides mission-specific forecasts tailored for AFSOF **aircrews** including en route, destination and TDA forecasts. If refractive effects data are needed, lightweight upper air measurement systems will be required to provide temperature and moisture profiles to the tropopause. In addition, measurements of other non-standard parameters may be required to support unique missions. Host base forecasts are coordinated to meet unique AFSOF requirements. Long-range planning forecasts are provided by the TWC.

3.6.1.3 **FIRST-IN COMMUNICATIONS NETWORK.** See Figure 3.3 for a description of initial weather communications capabilities. An

TABLE 3.3 AFSOF WEATHER SUPPORT CAPABILITIES

FORECAST CAPABILITY	FIRST-IN			SUSTAINMENT	
	AFSOC	AFSOD	FOL	AFSOC	AFSOD
UGDF	X	X		X	X
Indigenous Products	X			X	X
Other Service's Products	X			X	X
Graphics	X	X		X	X
Alphanumerics	X	X		X	X
Met Sensors	X	X	X	X	X
TARWI/PIREPs	X			X	X
TDAs (EOTDA, CTDA, IREPS, etc.)	X	X		X	X
Generate Products	X			X	X
Warnings/Alerts	X			X	X
Data Fusion	X			X	X
Climatology	X			X	X
Tailor UGDFs	X			X	X
Data Manipulation	X			X	X
METSAT	X	X*		X	X
Secure Communications	X	X	X	X	X

NOTE: X* - SMALL PORTABLE SYSTEM WITH LIMITED **METSAT** CAPABILITY

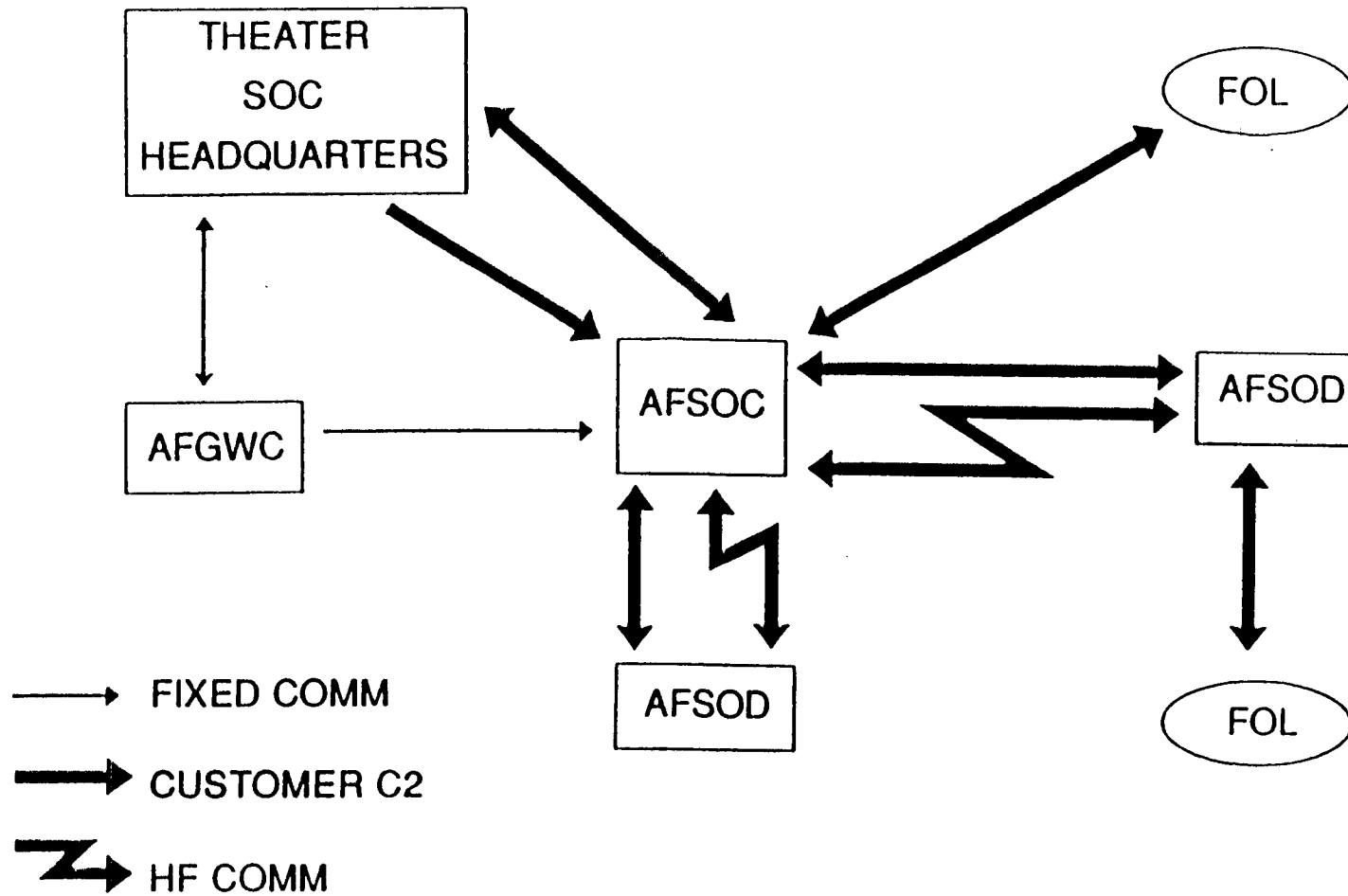


Figure 3.3

existing dedicated in-theater weather communications infrastructure is unlikely. During first-in, a primary connectivity with **AFGWC** for data receipt to the theater AFSOC will be required. In-theater HF weather communications or customer-provided **C2** connectivity will be used to send weather products between AFSOC and the AFSODs. Weather product dissemination between AFSODs and **FOLs**, as well as from the AFSOC to the theater HQ SOC, will rely on customer-supplied communications via command and control channels.

3.6.2 EQUIPMENT SIZE AND PACKAGING. All observing and forecasting equipment for the first-in capability at AFSOD or FOL levels must fit in standard Air Force two-person portable containers (85 **lbs/25** cubic feet) and should have a total weight of 600 lbs or less. First-in capability at AFSOC levels must be loaded into standard Air Force two-person portable containers and should occupy no more than 50 percent (but preferably no more than 25 percent) of a standard pallet. In addition to the hardware, the pallet must also contain a 30-day supply of spare parts and expendable items, to prevent loss in capability due to equipment problems prior to the-arrival of sustained support capability.

3.6.3 SUSTAINMENT CONOPS. Enhancements to the existing weather support during the sustainment phase include the ability to receive **DMSP** very high resolution imagery, both visual and IR, and other mission sensor data, such as upper air temperature and moisture profiles. Mission specific weather support will remain virtually unchanged.

3.6.3.1 SUSTAINMENT COMMUNICATIONS. AFSOF sustaining weather communications capabilities are shown in Figure 3.4. Sustaining communications capabilities differ from first-in capabilities in increased use of fixed "**hardwire**" communications during the sustaining phase of the contingency. The in-theater TWC will take advantage of backbone, customer in-theater communications networks established as part of the theater sustainment plan. TWC weather products will be distributed via the Air Force component fixed communication channels to the AFSOC. Fixed connectivity will extend from AFSOD levels up through the AFSOC to theater SOC **HQ** and the TWC. These communications will be predominately shared, rather than dedicated weather-only lines. However, **AO** HF communications will remain available during the sustaining phase as a backup when "hardwire" communications fail or as a primary capability when the AFSOD moves to another location and "hardwire" communications are not in place. Customer-supplied communications via C2 channels will continue to be the primary means of disseminating weather products between the AFSODs and **FOLs**.

AFSOF SUSTAINMENT CAPABILITY

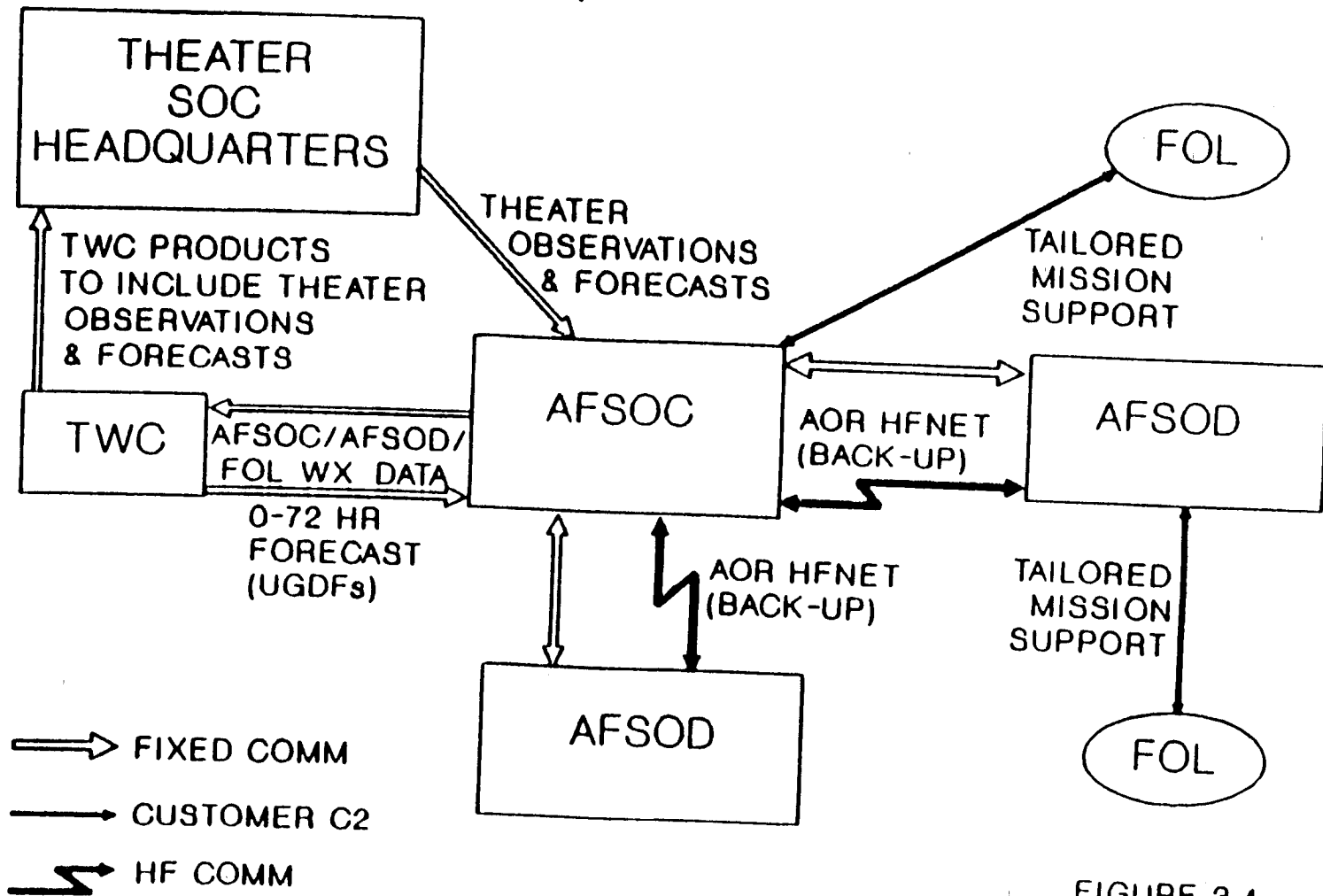


FIGURE 3.4

SECTION 4. SPECIAL TACTICAL WEATHER SUPPORT REQUIREMENTS

4.1 NON-COMBATANT EVACUATION ORDER (NEO) TANKER/AIRLIFT WEATHER SUPPORT. **AMC** strategy requires a "first-in" and "stand-alone" capability to support **NEO** and other humanitarian relief efforts by **AMC** worldwide, in all types of climatic conditions, and often in austere locations. Weather support for **NEO/humanitarian** mobility forces (airlift, tanker and Civil Reserve Air Fleet (**CRAF**) aircraft), primarily **CONUS** based, will focus on weather information affecting air routes (including air refueling (AR) tracks) to and from the **NEO/humanitarian** location(s), ports of embarkation (**POEs**), intermediate staging bases (**ISBs**), and alternates along the flow route.

Critical weather parameters are those which serve to optimize airflow (i.e., en route winds, landing/take-off minimums, etc.). Weather support consists of standard weather observing and forecasting capabilities to accompany **DTACC/TALCE** forces providing the command and control aspect of operations. Weather observations will include cloud base/type/coverage, visibility, pressure, temperature, dew point, surface wind speed/direction, and current weather conditions. Resource and personnel protection will rely upon severe weather observations from **AMC** weather observers/weather satellite data and available indigenous capabilities. **Airbase** forecast responsibilities include takeoff/landing forecasts and issuing weather warnings/advisories/watches meeting defined lead times. The first-in computer software must be based on the most current version of operational software employed in normal day-to-day base weather station operations in peacetime to ensure forecasters spend minimal time becoming proficient in equipment operations.

Not all **NEO/humanitarian** operations require deployed weather teams, especially if the **DTACC/TALCE** uses host indigenous weather capabilities. The decision to employ weather teams within the **DTACC/TALCE** package is driven by mission requirements, total package size, and, most importantly, the capabilities and reliability of the host country weather support. The requirement is to provide accurate, timely and reliable weather data (observations and forecasts) to **AMC** aircraft conducting **NEO/Humanitarian** operations.

4.1.1 OBSERVING. Weather teams accompanying the-TALCE need the first-in ability to provide standard parameter **weather observations (terminal** airfield observations). As such, the observing force will be sized according to the supported **CINC** operational mission requirements. Observing equipment must be two-person portable (i.e., small and lightweight), modular, accurate, reliable, ruggedized, easy and quick to set-up/tear-down, easy to operate, operator maintainable (card/circuit

board replaceable), and provide for an automatic relay of observations to the local weather team and to aircraft capable of receiving them.

For extended **NEO/Humanitarian** support operations, the follow-on **observing** capabilities of a lightning detection system and upper air measurement capabilities may be required.

4.1.2 **FORECASTING/COMMUNICATIONS.** Weather teams, when accompanying the **TALCE**, also need the capability to provide forecasting capabilities for operational support and resource protection. As such, the forecasting force will be sized according to the supported **CINC's** operational mission requirements. Equipment must be two-person portable, modular, accurate, reliable, ruggedized, easy and quick to set-up/tear-down, easy to operate, and operator maintainable (card/circuit board replaceable). Centralized weather support products (alphanumerics, graphics and **UGDFs**) will be provided via **SATCOM/secondary** broadcast system (e.g. **HFRB**) direct to the **TALCE** weather team from **AFGWC**; the AMC Tanker Airlift Control Center (AMC TACC) Weather Support Unit (WSU) will use AFGWC products to support airborne **aircrews** via customer **C2** system (see Figure 4.1). In addition, first-in requirements include:

a. Receipt of low resolution **METSAT** imagery (all weather type satellites);

b. Ability to interface with communications systems (**AFWCCS**, **AFMSS**, Global Decision Support System (**GDSS**), Command and Control Information Processing System (**C2IPS**), **DDN**, sister service, etc.) i.e., robust communications. Communications must be secure.

4.1.3 **MAINTAINABILITY AND SUSTAINABILITY.** The maintenance concept will be one of limited operator maintenance (card/circuit board replacement) primarily with enough critical spares to enable the forecasting systems to operate for a minimum of 30 days using the system self-diagnostic capabilities. Inherent **DTACC/TALCE** maintainers will be used to the maximum extent to repair systems in the field. Any other maintenance will involve a spare flown in for replacement and the failed item returned to home station for repair.

For extended operations during the sustainment phase of a contingency, **SWOs** will arrange for resupply for deployed equipment and **RSK** through **CINC** resupply channels. This resupply concept should mirror that for other functional areas supporting the **CINC**.

NEO OPERATIONS DATA FLOW (AMC STAND ALONE)

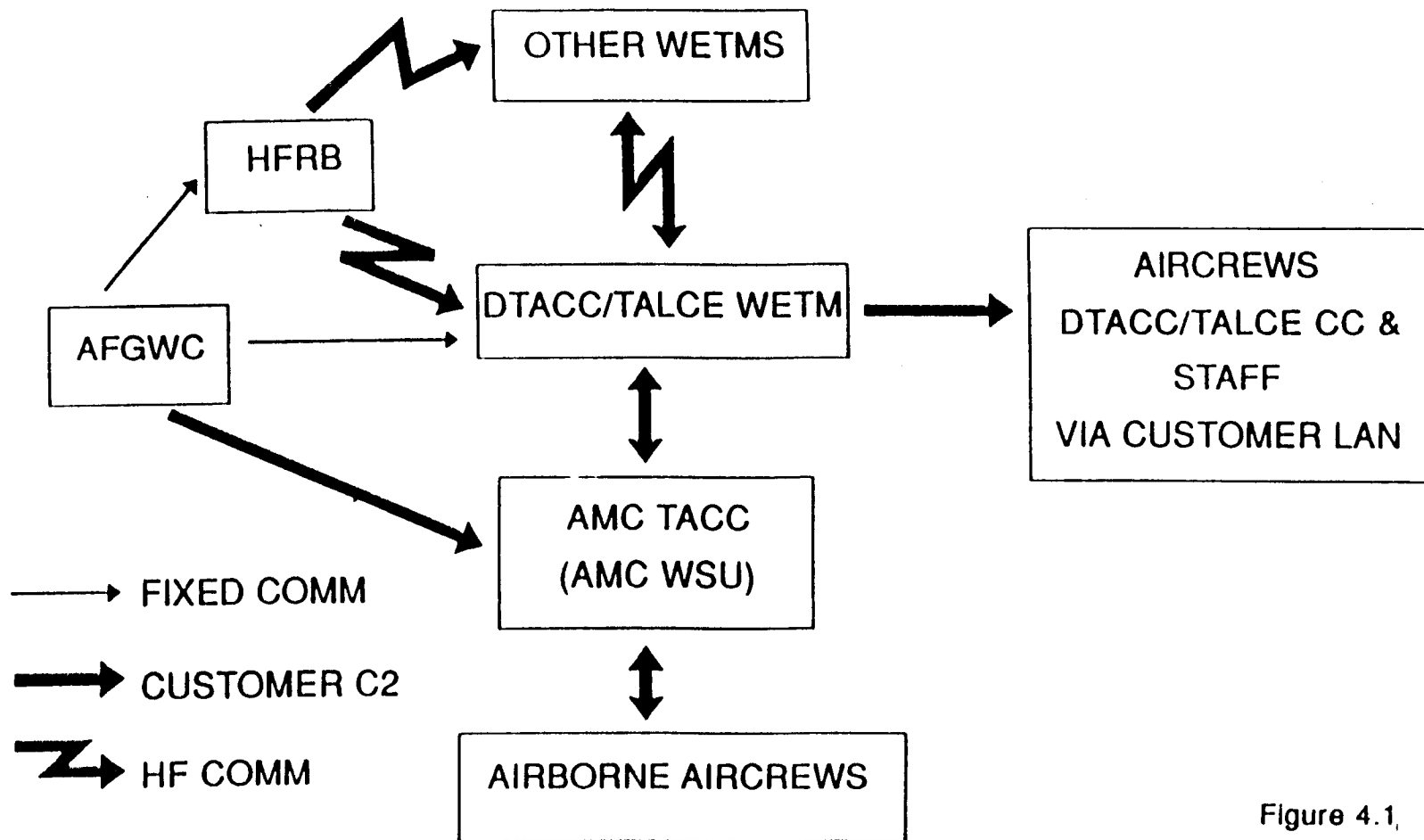


Figure 4.1,

4.1.4 CENTRALIZED WEATHER SUPPORT. AFGWC will directly support DTACC/TALCE weather teams. The AMC TACC WSU will support airborne crews using AFGWC products.

4.2 AIR FORCE SPECIAL OPERATIONS FORCES (AFSOF) "STAND-ALONE"-OPERATIONS. AFSOF weather support capabilities require a "stand-alone" capability as well. Its role is similar to that of "leading-edge"* operations and dictates future tactical weather equipment be modular and of a size and weight that is ruggedized, two-person portable, and have the communications needed to interface with the customer's command and control system. Support to AFSOF operations may require dedicated weather support to a deployed Air Force Special Operations Command (AFSOC), one or more Air Force Special Operations Detachments (AFSOD), and forward operating location (FOL).

AFSOC support from a deployed weather team includes 24-hour/day SWO, mission planning, and briefing support to the Commander, staff, and aircrews. The assigned mission and location of the AFSOC will drive the type of weather support required. If the AFSOC deploys to a bare base without existing observing and forecasting capability, the weather team will require additional forecasting and observing augmentation to provide airfield support.

AFSOD support will usually be limited to supporting flying operations. If, base weather station services are required, additional observing and/or forecasting augmentation is required for 24-hour/day forecasting/observing plus staff and mission briefing support.

FOL support needs are normally handled remotely from the AFSOC or AFSOD locations *using command and control communications only.

4.2.1 STAND-ALONE CONOPS. Prior to deployment, AFGWC will be notified to begin generating previously identified specific forecast products. Communications requirements do not change from those needed for first-in theater capabilities. See Section 4.2.4.

Immediately upon arrival at the deployed location, the weather team at the AFSOC level will begin providing tailored mission forecasts. Until such time as fixed connectivity allows for receipt of UGDFS from AFGWC, the weather team will use its organic satellite receiving capability, HF connectivity to other locations, and secondary broadcast system (e.g. HFRB) to provide forecasts.

The AFSOD weather team initially relies on HF receipt of AFSOC-tailored mission products, secondary broadcast system (e.g. HFRB) data receipt, climatological data bases, and local observations to provide needed support.

Weather support to **FOLs** is usually limited to remote weather briefings from AFSOC or the **AFSODs**. If operational missions are staged out of an FOL, observers and forecasters may be deployed to provide tailored mission support using customer communications only. Communications restrictions and/or mission sensitivities will drive this requirement.

4.2.1.1 **AIRBASE OPERATIONS**. If required, airfield support will be provided by an augmented special operations weather team. Observing and forecasting equipment must be lightweight, man-portable, easy and quick to set-up and tear-down, autonomous in its operation, and provide automatic relay of observations through the AFSOC to AFGWC depending on the capabilities of the communications system and the sensitivity of the operation. Observations must include cloud/base/type/coverage, visibility, pressure, temperature, humidity, surface wind speed/direction, and current weather conditions. If refractive effects data are needed, lightweight upper air measurement systems will be required to provide temperature and moisture profiles to the tropopause. In addition, measurements of other non-routine parameters may be required to support unique missions. Operational requirements will drive the need for, and the accuracy of, specific observations to meet the mission requirements.

Airbase forecast responsibilities include producing take-off/recovery forecasts and issuing **weather** warnings and advisories. AFSOC forecasting hardware must be capable of adjusting and modifying centrally-generated **UGDFs** covering the entire operational area. Therefore, the AFSOC weather team will depend on receiving baseline UGDF forecasts from AFGWC. These baseline UGDF forecasts need to focus on the 12 to 14 hour planning cycle for base operations and sortie generation, as well as 24 to 72 hour outlook for the deployed area of operations.

4.2.1.2 **MISSION SPECIFIC PLANNING/FORECAST WEATHER**. Normally AFSOF forces deploy to locations which are already supported by other weather personnel (allied or indigenous). The host base weather function provides the official airfield observation and take-off/recovery forecasts. The **AFSOC/AFSOD** forecaster provides mission-specific forecasts tailored for AFSOF **aircrews** including en route, destination, refractive effects, and **EOTDA/CTDA** forecasts. Host base forecasts are coordinated to meet unique AFSOD requirements. Long-range planning forecasts (greater than 72 hours) are provided by AFGWC. Forecasters will tailor

baseline UGDFs from AFGWC to cover the **entire** operating area. In addition, the forecaster will tailor UGDFs for the AFMSS. The AFMSS automates the flight planning function for the aircrew including weapon loads, **EOTDAs**, **CTDAs**, and weather conditions along key route points, to include alternate and divert airfields.

Satellite measurements will continue to be a principal means of observing weather across the AO. The equipment must be small, lightweight and portable, and receive visual and IR polar orbiting imagery at a high refresh rate.

4.2.2 EQUIPMENT SIZE AND PACKAGING. All observing and forecasting equipment for the stand-alone capability at AFSOD or **FOL** levels must fit in standard Air Force two-person portable containers (85 **lbs/25** cubic feet) and should have a total weight of 600 **lbs** or less. Stand-alone capability at AFSOC levels must be loaded into standard Air Force two-person portable containers and should occupy no more than **50** percent (but preferably no more than 25 percent) of a standard pallet. In addition to the hardware, the pallet must also contain a 30-day supply of spare parts and expendable items, to prevent loss in capability due to equipment problems prior to the arrival of sustained support capability.

4.2.3 MAINTAINABILITY AND SUSTAINABILITY. The maintenance concept is the Air Force's two-level concept for deployed operations. At AFSOC and AFSOD levels, on-site operator maintenance will consist of remove and replace modules. Equipment needing more complex maintenance/repair will be returned to home station for repair.

For extended operations during the sustainment phase of a contingency, **swos** will arrange for resupply for deployed equipment and RSX through CINC resupply channels. This **resupply** concept should mirror that for other functional areas supporting the CINC.

4.2.4 COMMUNICATIONS NETWORK. By the nature of AFSOF missions, communications systems must be secure, flexible, mobile, autonomous, reliable, survivable, and be of a size and weight to fit the limited space allotted by deployment constraints. AFSOF stand-alone weather communications are shown in Figure 4.2. An existing dedicated in-theater weather communications infrastructure is unlikely.

4.2.5 CENTRALIZED WEATHER SUPPORT. AFGWC will provide all required central products including UGDFs. Since the baseline

AFSOF STAND-ALONE CAPABILITY

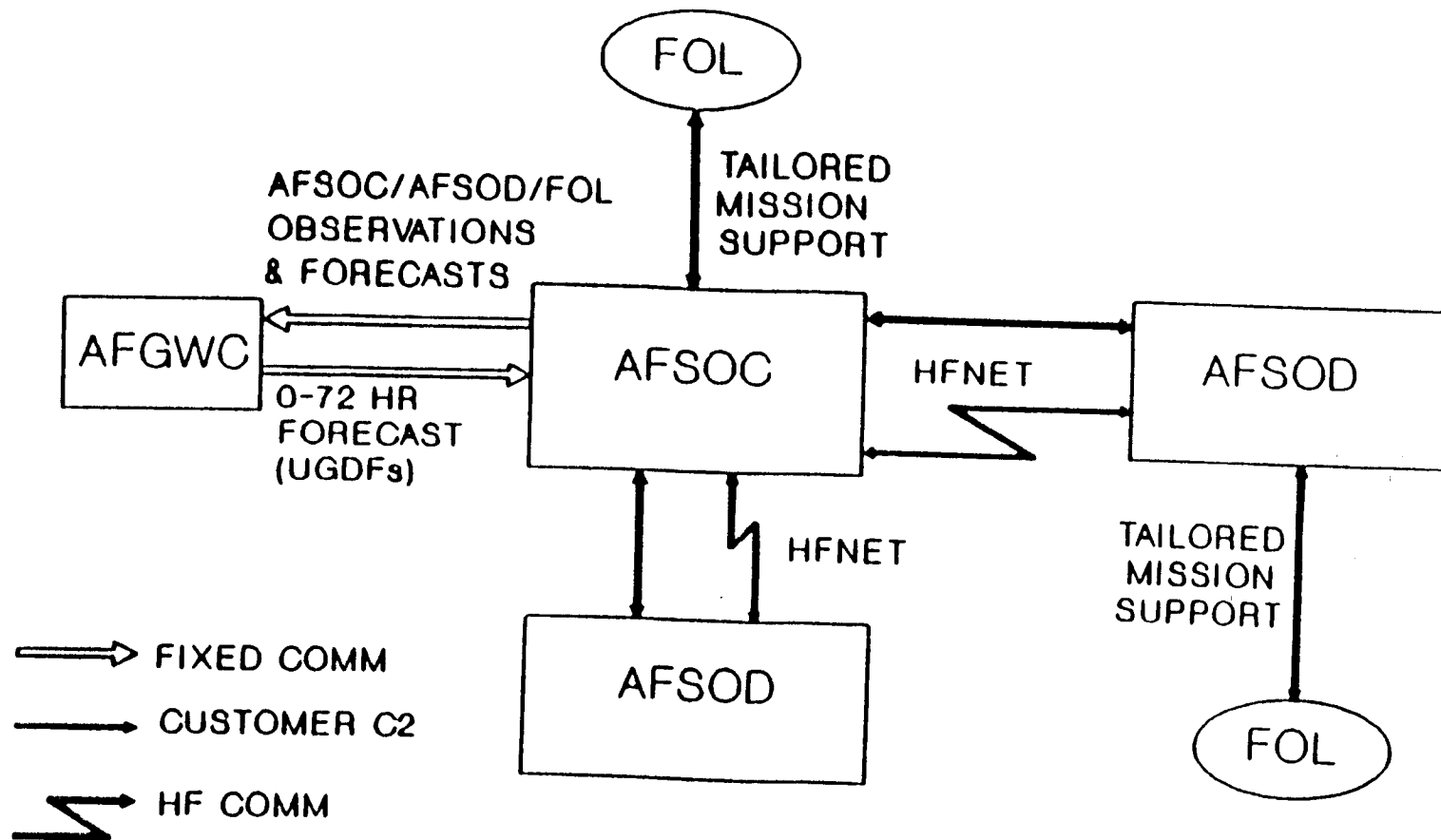


FIGURE 4.2

UGDFs are a very large database, transmission requires high speed fixed backbone circuitry or SATCOM-like connectivity. If AFGWC connectivity becomes unavailable or lost, the baseline **UGDFs** will be backed up by a special set of secondary broadcast system (e.g. HFRB) products (e.g. forecast fields in vector graphic form and recommended **climatological** UGDF selection). "Common-user" in-theater HF communications will be established to disseminate weather products between the AFSOC and AFSODs. As soon as the communications architecture is established, weather teams will transition to "common-user" in-theater customer-supplied communications, via command and control channels, to disseminate weather products between AFSOC, the AFSODs, and **FOLs**. AFSOC will be responsible for relay of observations from **the** AFSODs and **FOLs** back to AFGWC.

ACRONYMS/ABBREVIATIONS

ACC	Air Combat Command
AFFOR	Air Force Forces
AFGWC	Air Force Global Weather Central
AFMSS	Air Force Mission Support System
AFSFC	Air Force Space Forecast Center
AFSOC	Air Force Special Operations Command
AFSOD	Air Force Special Operations Detachment
AFSOF	Air Force Special Operations Force
AFWCCS	Air Force Wing Command and Control System
AMC	Air Mobility Command
AMC TACC	Air Mobility Command Tanker Airlift Control Center
AO	Area of Operations
AOR	Area of Responsibility
AR	Air Refueling
ATM	Air Tasking Message
ATO	Air Tasking Order
CAF	Combat Air Forces
CCA	Circuit Card Assembly
CCT	Combat Control Team
C-day	Commencement Day
CDM	Chemical Downwind Message
CDS	Container Delivery System
CINC	Commander in Chief
CONOPS	Concept of Operations
CRAF	Civil Reserve Air Fleet
CSSC	Command Supported Systems Center
CTAPS	Contingency Tactical Air Control System Automated Planning System
CTDA	Conventional Tactical Decision Aid
C2	Command and Control
C2 IPS	Command and Control Information Processing System
DDN	Defense Data Network
DMSP	Defense Meteorological Satellite Program
DTACC	Deployed Tanker Airlift Control Center
D-Value	Deviation Value
EDM	Effective Downwind Message
EO	Electra-Optical
EOTDA	Electro-Optical Tactical Decision Aid
FBD	Formatted Binary Data
FCST	Forecast
FLOT	Forward Line of Own Troops
FOL	Forward Operating Location
GDSS	Global Decision Support System
HF	High Frequency
HFNET	High Frequency Network
HFRB	High Frequency Radio Broadcast
HQ	Headquarters

HWD	Horizontal Weather Depiction
IR	Infrared
IREPS	Integrated Refractive Effects Prediction System
ISB	Intermediate Staging Base
JOAF	Joint Operations Area Forecast
JTF	Joint Task Force
LAN	Local Area Network
LAPES	Low Altitude Parachute Extraction System
LBS	Pounds
MAJCOM	Major Command
MDT	Mean Down Time
MET	Meteorological
METSAT	Meteorological Satellite
MTBF	Mean Time Between Failure
MTBCF	Mean Time Between Critical Failure
MTTR	Mean Time to Repair
NBC	Nuclear/Biological/Chemical
NEO	Non-Combatant Evacuation Order
NM	Nautical Mile
OA	Operational Availability
OBS	Observations
PGM	Precision Guided Munitions
PIREPS	Pilot Reports
POE	Port of Emarkation
RDS	Realtime Data-Smooth
RSK	Readiness Spares Kit
R&D	Research and Development
SATCOM	Satellite Communications
SOC	Special Operations Command
SOF	Special Operations Force
SOWT	Special Operations Weather Team
SQOC	Squadron Operations Center
STT	Small Tactical Terminal
SWO	Staff Weather Officer
TALCE	Tanker Airlift Control Element
TAWDS	Transportable Automated Weather Distribution System
TARWI	Target Weather Information
TDA	Tactical Decision Aid
TFS	Tactical Forecast System
TWC	Theater Weather Center
UAV	Unmanned Air Vehicle
USAF	United States Air Force
USAFETAC	United States Air Force Environmental Technical Applications Center
UGDF	Uniform Gridded Data Fields
VG	Vector Graphics
WETM	Weather Team
WOC	Wing Operations Center
wsu	Weather Support Unit
WVO	Wing Weather Officer

DRAFT

HEADQUARTERS AIR WEATHER SERVICE

DIRECTOR OF OPERATIONS

PART II

Concept Paper for Air Force Weather Support to **Army**
Theater Operations

1995 - 2005

13 August 1992

DRAFT

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SECTION 1. ARMY THEATER OPERATIONS

1.1 ARMY OPERATIONS. Army operational concepts of the future are delineated in U.S. Army Training and Doctrine Command (TRADOC) Pamphlet, TRADOC PAM 525-5, **AirLand** Operations, A Concept for the Evolution of **AirLand** Battle for the Strategic Army of the 1990s and Beyond. TRADOC PAM 525-S describes specifics of the nonlinear battlefield fought in an expanded area. U.S. Army Field Manual **100-5**, Operations, further describes the "how to fight" basic doctrine for **AirLand** Operations. The predominant concepts of **AirLand** Operations are that the Army will participate in joint, combined, or interagency operations across the operational continuum.

1.1.1 ASSUMPTIONS. Ground combat operations are affected by the mission, enemy, terrain, troops, and time available. Knowledge of weather effects on these factors enhances the tactical commander's analysis of the current situation and decision making on employment of combat power. The following are integral to this section of the CONOPS:

1.1.1.1 THE BATTLEFIELD. The battlefield will be nonlinear without distinct dividing lines between opposing forces and will extend out several hundred kilometers beyond the forward element of friendly forces. Rather than a limited battlefield for force against force, both massed in depth and fighting a war of attrition, commanders will instead use a battlefield of greater breadth and depth to conduct operational maneuvers and bring superior technology to bear on selected elements of the enemy force. Success requires superior intelligence, the ability to shape or condition the battlefield at depth, and the agility to exploit opportunities. These changes make weather an important factor in Army planning and execution.

1.1.1.2 ROLES. Echelons above corps (EAC) and corps will play a major role in planning and system employment decisions.

1.1.1.3 MOBILITY. Army units will be highly mobile and weather teams will have the same degree of mobility as the units they support.

1.1.2 FUTURE FOCUS. The Army's vision of force deployment and employment for the future is to maintain a trained force, in a high state of readiness, to provide deterrence against those obstacles to national strategy through presence or crisis response. The Army will be trained to fight as a joint or

combined force from battalion task force to theater level. Combat training centers will increase in number during the period 1995 to 2005 to meet increased training requirements.

1.1.2.1 FORCE SIZE AND DEPLOYMENTS. In the 1995-2005 **time** period, the Army will reshape the force to accommodate the new concept of a fully trained, highly deployable force to rapidly project combat power from the Continental United States (**CONUS**). A contingency corps composed of several rapidly deployable divisions in the **CONUS** will provide power projection capability to deploy on short notice to regions of potential conflict. This force can be tailored, will have a forced **entry** capability, and will be capable of sustaining operations for 30 days with only limited reliance on Reserve component augmentation. Additional active and Reserve forces to reinforce rapidly deployable divisions will be available after a period of mobilization. There will be active divisions with **roundout** Reserve component brigades and full Reserve component divisions.

1.1.2.2 DOCTRINE. Army doctrine provides fundamental principles to guide the employment of land forces and is the framework for training, equipment modernization, and force structure. In 1995-2005, mobilization and deployment from a **CONUS** base to the region of crisis will be the rule. Therefore, Army doctrine will focus training on deployability and versatility.

1.1.2.3 MODERNIZATION PROCEDURES. As the **Army** modernizes, it will not be able to field all technological capabilities available. New developments are expected to be available at an ever more rapid pace than in the early 1990s. To enable "leap ahead technology" to be most easily integrated into existing systems, the Army plans to use an open architecture concept enabling new systems and capabilities to interact with existing systems through common command, control, communication, and computer protocols. Within this context the Army will continue to modernize by acquiring weapon systems with the greatest lethality, and by fielding advanced warfighting capabilities. The Army will outfit its combat units with new equipment, giving first priority to the force package first to fight. The Army four force package structure assigns units according to their mission and potential for deployment. As modernized equipment is fielded to units in a force package, useful equipment it replaces cascades down to the next force package. Least-capable equipment is retired as early as possible to maintain unit readiness. Prior to development of new equipment, force structure, doctrine, and tactics will be adjusted and considered as possible **cost-effective** alternatives to new equipment.

1.1.3 AIRLAND OPERATIONS. The basic tenets of **AirLand Battle--initiative**, agility, depth, and synchronization--are expected to remain applicable in the future as the Army transitions to the doctrine of **AirLand Operations**. Understanding the interaction of weather with the tenets of **AirLand Operations** through the Intelligence Preparation of the Battlefield (IPB) and other processes described in the Intelligence, Electronic Warfare (IEW) Battlefield Operating System enhances warfighting capability and allows knowledge of weather to become a combat multiplier.

1.1.3.1 INTELLIGENCE PREPARATION OF THE BATTLEFIELD (IPB). IPB is a cyclic process coordinated by the **G2/S2**, Terrain Team, and WETM. Future IPB functions will be performed continuously and simultaneously vice clear-cut individual steps. The primary goal of weather support in the IPB **process** is to totally integrate weather into the development of a focused intelligence product that is linked to the Army component commander's **scheme of maneuver** and primary intelligence requirements. To achieve this goal, weather analysis and impacts will need to be graphically integrated into the focused intelligence product produced from the battlefield area evaluation process and threat integration analysis. Battlefield area evaluation assesses the area of influence and area of interest as the basis for terrain, weather, and threat analysis and results in threat integration. Threat integration analyzes threat doctrine with weather and terrain to determine the enemy courses of action within the specific battlefield environment. During terrain analysis, the Terrain Team evaluates how terrain attributes affect the commander's concept of operations and uses detailed weather information, especially precipitation amounts over the area of interest and adjacent areas that affect trafficability, stream flow for river crossings, and other maneuver conditions. Using battlefield automated systems, the **WETMs** develop tailored computerized products of weather conditions over the last several days and forecasts for specified times in the future. The Terrain team combines the computerized weather products with tailored computerized terrain condition products to determine the overall environmental impact on air and surface operations. In this way, **WETMs** can concentrate on producing automated weather decision information and eliminate the need for the time-consuming process of drawing weather charts and manually integrating weather data into the IPB process. Climatology displays, in the same formats, are used for contingency planning before deployment to the theater of operations. Weather analysis assesses the impacts of weather elements on friendly and threat weapons systems, personnel, and maneuver.

1.1.3.2 INITIATIVE. Initiative will set or change the terms of battle through decisive action. Timely, accurate weather products help identify windows of opportunity. The commander may

then seize the initiative and take advantage of **conditions** adversely affecting the enemy, bringing the required force:: and firepower to bear at the optimum time and place on the battlefield.

1.1.3.3 **AGILITY.** The commander will use agility most effectively when he has an accurate assessment of mobility based on IPB weather and terrain analyses. He will be able to react faster than threat forces and exploit enemy vulnerabilities through maneuver. Maximum agility also enables the commander to protect **C2** assets.

1.1.3.4 **DEPTH.** Depth is the extension of combat operations in space, time, and resources. The commander needs accurate **and** timely weather forecasts to evaluate his capability to maneuver **or** fire against high-value targets. Advance knowledge of environmental effects on mobility and firepower will assist the commander in using his forces to maximize deep-strike capabilities and minimize vulnerability.

1.1.3.5 **SYNCHRONIZATION.** The commander executes a **synchronized** attack of highly lethal firepower at the critical time to **enable** him to fight high intensity conflicts outnumbered, yet still win. Accurate weather forecasts and detailed knowledge of adverse weather effects analysis on warfighting equipment enable the commander to evaluate the forces' capability to maneuver. With this knowledge, the commander will be better able to synchronize a wide array of forces into a combined arms team attacking enemy vulnerabilities and forces.

1.1.4 **OPERATIONS SHORT OF WAR.** **AirLand** Operations recognize that the most likely threats to national interest will see the Army employed in operations short of war. These actions include support for insurgency and counterinsurgency missions, combatting terrorism, peacekeeping operations, and what **TRADOC** PAM 525-5 classifies as contingency operations; including nation assistance, disaster relief, counter-drug operations, noncombatant evacuation operations, and show of force deployments. These operations are inherently interagency, involving multiple service components and government agencies, such as the State Department. Weather support can be provided either indirectly from existing fixed sites or directly by deployed US **WETMs** and/or a mix of host nation and deployed **WETMs** at Echelons Above Corps.

1.1.5 **DEPLOYMENT.** Limited Army forces may already be stationed in a theater (e.g., forward-based forces in Germany, Korea, etc.)

but the majority of forces will deploy to a theater (e.g., **JUST CAUSE**, **DESERT SHIELD**) from **CONUS**. In general, forward-based forces will respond to offensive actions of an enemy by moving overland from basing locations to assembly areas, and then engaging the enemy. The time and distance involved can be **short** or long depending on the nature and location of the contingency. In contrast, deploying forces will often travel great distances and take days to weeks to reach their staging locations. Those deploying will either force their way in (lodgment) or have host-nation approval for their actions. When a lodgment or forced entry operation is called for, a mix of intertheater and intratheater airlift will be used to move the initial force packages. Contingency forces are organized in units as small as battalion and brigade task force-sized packages depending on the situation; the remaining division elements follow at a later time. When deploying to a reasonably stable theater with host-nation approval, a more orderly buildup is appropriate, and larger forces will be deployed using a mix of airlift and **sealift**.

1.1.6 EMPLOYMENT. The operational level of ground warfare will be directed by the Army component commander of the tasked unified command. In **a** mature theater, or operations involving **multi-**corps, an EAC commander will command and control the ground force in joint, unified, **or** combined operations. In other situations, the Army component may involve **a** single corps, or less. For example, at a level of conflict well below that of theater warfare, the Army component may be **part of a Joint Task Force**. Under any circumstances, the senior Army component-level commander will direct ground warfare.

SECTION 2. WEATHER SUPPORT TO ARMY FORCES

2.1 WEATHER SUPPORT CONCEPTS. Weather support to Army forces is based on the following concepts:

2.1.1 DOCTRINAL SUPPORT AND POLICY. The Army and the Air Force jointly specify where weather support services (SWO, forecasting, and observing) are required in Army Field Manual **34-81**/Air Force Manual **105-4**, Weather Support for Army Tactical Operations, and Army Regulation **115-10**/Air Force Regulation 105-3, Meteorological Support for the US Army.

2.1.2 AIR FORCE RESPONSIBILITIES. Responsibilities for Air Force elements engaged in weather support to the Army are stated in detail in Army Regulation **115-10**/Air Force Regulation 105-3, Meteorological Support for the US Army.

2.1.3 STAFF WEATHER OFFICER (SWO). The **SWO** is an Air Force officer supporting Army echelons by providing direct weather support to the Army unit to which the officer is attached. The **SWO** coordinates directly with the supported Army unit commander and staff concerning weather support. The **SWO** is a member of the commander's special staff, under the general staff supervision of the G2. The **SWO** and the WETM are under the operational control of the Army commander they support.

2.1.4 ARMY RESPONSIBILITIES. Responsibilities for Army elements engaged in weather support to the Army **are** stated in detail in Army Regulation **115-1S**/Air Force Regulation 105-3, Meteorological Support for the US Army.

2.1.5 TABLES OF ORGANIZATION AND EQUIPMENT (TOE). Army forces deploy, assemble, and maneuver on the battlefield with a single set of equipment which meets all necessary support requirements. The Army provides personal field equipment and communications equipment for Air Force **WETMs** authorized by the Army-supplied TOE. The Army prepares **TOEs** to conform with a unit's doctrinal mission. All major items of equipment supplied to a **WETM** by the Army will be included on the TOE of the supported Army unit. To improve combat capability, Army commands may purchase nondevelopmental items (NDI) to allow units to exploit **technological** advances. The **NDI** equipment may be subsequently added to the unit's TOE. Other personal field equipment is authorized and issued according to the Army Common **Table** of Allowance.

2.1.6 COMMUNICATIONS. At each echelon work center where the Army requires direct forecasting services, secure communications capabilities are needed to receive the following product types: uniform gridded data fields (**UGDFs**), **vector** graphics, alphanumerics, and formatted binary data; voice; and direct receipt of DMSP and civil meteorological satellite imagery as well as DMSP mission sensor data. These work centers also require the capability to receive, tailor, and disseminate weather information into specific products for the units being supported.

2.1.7 WETM LOCATION. Optimum WETM forecasting location is adjacent to either the intelligence production site or the tactical operations center (TOC).

2.1.8 RECONNAISSANCE. The Army employs space and earth-based reconnaissance systems to gather information on the location of enemy targets, particularly the disposition of enemy forces. Weather conditions affect both the performance and the collection efficiency of these systems; accurate weather forecasts are needed to plan and optimize the effectiveness of limited reconnaissance assets.

2.1.9 WEATHER EFFECTS ON PERSONNEL/EQUIPMENT. Weather conditions, particularly extremes of temperature, moisture, and wind, affect performance of soldiers and equipment. Since soldiers and their equipment can be exposed to these **extreme** conditions continuously during maneuver, long-range planning forecasts (10 days out) are needed so ground-force commanders can **adjust** plans to ensure soldiers' safety and maximum effectiveness of support equipment. Advance warning allows commanders to physically protect soldiers during extreme heat or cold events, and enables psychological preparation of personnel for environmental conditions. Accurate long-range planning forecasts will help protect and maintain both warfighting and support equipment.

2.1.10 WEATHER EFFECTS ON HIGH TECHNOLOGY SYSTEMS. As the Army fields an array of night-vision devices, short- and long-range precision guided **munitions**, and automated C2 systems, battlefield commanders will become dependent on many systems whose performance is impacted by weather elements such as precipitation, clouds, and humidity. To help the commander integrate information on this wide array of equipment, the **Army** is developing an Automated Tactical Command and Control System (ATCCS). Weather analysis and forecast production systems must be capable of interfacing with Army automated C2 systems so that_

weather support data and products can be disseminated to each customer node.

2.2 WEATHER SUPPORT TO **ARMY** UNITS. The type of weather support products provided to Army units depends on the unit's size, mission, and location on the battlefield. Forecast products required for the various echelons are depicted in Table 2.1,

2.2.1 ECHELONS ABOVE CORPS (EAC) WEATHER SUPPORT. **EACs** vary in organization from theater to theater and the structure described here may be modified. A multi-corps force is described, although variations and smaller EAC forces may be required in a **single** corps operation. In a fully matured theater, the EAC WETM will operate from up to six locations.

2.2.1.1 EAC MAIN **COMMAND** POST. The EAC Main WETM supports the EAC Army commander and his staff (primarily the **G2**), by preparing weather products which provide decision information to **assist** the EAC staff in theater operational level planning. This WETM provides SWO, 24-hour forecasting and observing support to the EAC commander, staff, and support elements. It receives **UGDPs** valid out to 48 hours and vector graphic and other forecast products valid 96 hours and beyond from **AFGWC** and/or TWC. It disseminates EAC forecast products to echelons corps and below (ECB) WETMs, receives available surface data and upper air soundings collected by ECB WETMs, sends these collected data to the TWC for use in building theater-level products for all component forces. The EAC Main WETM performs quality control an information flowing from the ECB WETMs and tailors **information** flowing from the TWC.

2.2.1.2 EAC REAR **COMMAND** POST. The EAC Rear Command Post manages combat service support for the theater. The EAC rear WETM has the capability to assume control from the **EAC** main WETM for short periods during EAC main relocation, as well as the ability to assume full-time control in the event the main is destroyed or rendered ineffective. As such, it receives the **same** observation and forecast products as the **EAC** main WETM. It must also have the people, equipment, and communications **connectivity** necessary to disseminate products to ECB WETMs. This WETM is **responsible for** providing **SWO** and 24-hour forecasting and observing support to the Theater **Army** Area Commands. Ten-day forecasts for aerial and seaports of debarkation are required to plan and monitor the movement of troops and supplies from ports of debarkation into the communications zone (**COMMZ**) and the combat zone. These forecasts, produced daily by the TWC, need to include maximum and minimum temperature, wind, visibility, sea states, and weather conditions anticipated at the ports for each

day of a 10-day period.

2.2.1.3 EAC INTELLIGENCE CENTER (EACIC). The EACIC performs theater **intelligence and electronic** warfare functions. The WETM provides theater IPB inputs. Direct support is provided by a **SWO** and 24-hour forecasting function. Using weather information from the TWC, and both analysis and forecast information from the EAC WETM, weather in the area of interest and the area of influence is analyzed for its effects on friendly and enemy operations. The Army terrain team analyzes the effect of terrain and weather interactions on friendly and enemy operations. Weather decision information tailored by the WETM is integrated with the terrain data to **generate computerized** displays. The WETM **also** prepares tailored forecasts for the **EACIC's** target development, electronic warfare, counterintelligence, and indications and warning functions. The WETM is responsible for providing forecasts to **assist the Military Intelligence (MI)** commander in employment of MI brigade collection assets. These forecast products, including, the graphic overlay inputs, will be transmitted electronically to other EAC automated systems.

2.2.1.4 THEATER AVIATION BRIGADE (TAB). The theater aviation brigade provides **air** movement support for the theater Army. The brigade also **has** the capability to support joint or combined campaigns and major operations. The brigade can provide combat capabilities to assist in rear area security operations. Weather support includes **SWO** and 24-hour forecasting at the tactical operations center (TOC) and 24-hour observing support **at a** landing zone (LZ). Observations will be relayed from the LZ to the TOC via radio or **landline** voice transmission. Observations for **LZs** must include standard airfield observation elements (temperature, **dewpoint** temperature, **current** weather, visibility (including restrictions), pressure, wind, and cloud type, height, and amount information).

2.2.1.5 THEATER AIRFIELDS. The EAC WETM **also** provides 24-hour direct observing and indirect forecasting support from the EAC main or rear command post for up to two fully instrumented airfields **in the** COMMZ. Standard airfield observations are required.

2.2.2 CORPS. As the highest tactical echelon, the corps directs, coordinates, and allocates resources for operations in its **area of interest out to 96 hours**. **Tactics are the art by which** corps and smaller unit commanders translate combat power into victory. The corps WETM supports the development and execution of these tactics by providing commanders with weather observations and tailored forecast information. The corps WETM will operate at the following locations:

2.2.2.1 CORPS TACTICAL OPERATIONS CENTER (TOC). The corps WETM provides direct weather support to the Corps TOC (CTOC) and indirect support to the rear CTOC. This **WETM** provides the commander and his staff (primarily the corps G2) with SWO and 24-hour forecasting and observing support. This includes forecasts out to 96 hours for planning operations and computerized weather decision information for the IPB process. The WETM has a capability to retransmit a limited number of EAC Main WETM products to subordinate echelon **WETMs** which missed product transmissions. The **WETM** also tailors EAC Main WETM information for the corps and ensures consistency of weather decision information in the corps area. It ensures observations and target area weather information taken by subordinate **WETMs** and Army **sources** are passed to the EAC Main WETM.

2.2.2.2 CORPS COMBAT AVIATION BRIGADE (CAB). The corps CAB WETM provides **SWO** and 24-hour forecasting and observing support to produce tailored planning and mission execution weather decision information to the brigade staff and aircrews. The CAB operates out of a geographically separated corps LZ, requiring the CAB WETM to be capable of operating separately from the CTOC **WETM**.

2.2.2.3 CORPS AIRFIELDS. The corps WETM also provides 24-hour direct observing support at up to two corps airfields. Additionally, 24-hour forecasting services are available at one corps airfield to support the Aerial Exploitation **Battalion (AEB)** reconnaissance and surveillance missions. Forecasts will be tailored for each **AEB** mission profile and sensing platform. Normally, forecasts will be provided via a computerized pilot briefing system. The goal is to have weather data drive an automated mission planning system for the pilot, thereby eliminating the need for traditional face-to-face aircrew briefings. Airfield forecasts will normally cover a 24-hour period.

2.2.3 DIVISION. As the basic tactical maneuver unit, the division is largely self-sustaining and possesses flexibility to tailor their brigades for specific missions in the division's area of influence. The division's area of influence is smaller than that of the corps, and the time frame of forecast requirements generally does not exceed 72 hours. Division weather support will be tailored to the division type. The weather support requirements of heavy divisions will vary from those of a light infantry, an airborne, or an air assault division. The division WETM will operate as follows:

2.2.3.1 DIVISION TOC (DTOC). The division **WETM** is manned for direct weather support to the DTOC and indirect support to the

rear TOC. The DTOC WETM provides **SWO** and 24-hour forecasting and observing support to the commander and his staff (primarily the G2). The WETM is usually collocated with the intelligence and terrain analysis teams. Tailored weather decision information integrated with tailored terrain data during the IPB process. IPB products are based on both **UGDFs** valid out to 36 hours and computerized displays valid out to 72 hours. Alphanumeric forecast products are also valid to 72 hours. Using the **SWO's** knowledge of critical thresholds, weather information is tailored to the division area of influence and the division's emphasis on employment of maneuver brigades to fight the direct fire battle. The WETM also provides specific weather decision information needed to support precision munitions planning and execution. The Army is responsible for manned or automated surface and upper air observations in the area forward of division main command post. This is in addition to observations by **WETMs** deployed in support of Army units (e.g., Armored Cavalry Regiment (ACR) or separate brigade) and does not preclude the Air Force from placing mobile observing teams (**MOTs**) in forward areas to take, collect, and relay weather observations and information. The goal is to use automated observing systems wherever possible. The DTOC WETM collects observations and target **area** weather information from subordinate **WETMs** and division Army sources and relays the information to higher echelons.

2.2.3.2 AIR ASSAULT DIVISION MANEUVER BRIGADE. Air assault divisions rely heavily on rotary-wing aircraft for their mobility. To support the numerous aviation missions, air assault division maneuver brigades require direct 24-hour forecasting and observing support at the brigade LZ in addition to the main DTOC and the division combat aviation brigade (CAB).

2.2.3.3 DIVISION COMBAT AVIATION BRIGADE (CAB). The division CAB performs attack and lift missions as directed by the division commander. The division CAB is physically separated from the division TOC and requires separate **SWO** and 24-hour forecasting and observing services to the aviation brigade commander and staff. The goal is to make tailored weather information available to drive a computerized pilot mission planning system for **aircrews** departing division **LZs**. Briefing support via radio or other voice communications will be used as backup. Automated observing equipment will be sited at these **LZs** to take standard airfield observations for relay to the CAB **WETM**.

2.2.3.4 MOBILE OBSERVING TEAMS (**MOTs**). Three **MOTs**, each capable of 24-hour operations, may be part of the division WETM. Each team has an Army vehicle and deploys to key locations when directed by the **SWO** (after coordinating with the G2 and brigade commanders) to take and/or collect, and relay observations to the

DTOC WETM. These observations include the standard elements (pressure, temperature, dew point, winds, visibility (and restrictions), cloud type, height, and amounts).

2.2.4 ARMORED CAVALRY REGIMENT (ACR). The ACR performs covering force **and screening** missions for the corps. The ACR receives direct **weather support** from a dedicated ACR WETM. The **WETM** is as mobile as the rest of the regimental support units and is capable of moving daily **or** more frequently., The ACR **WETM** is employed at the following locations:

2.2.4.1 REGIMENTAL TOC (RTOC). The ACR SWO, assisted by a forecaster, mans a briefing cell at the RTOC. The **SWO receives** weather observations and area forecasts covering the ACR area of interest from the Regimental Aviation Squadron (RAS) WETM **over** area communications, usually by radio or hard copy (facsimile) **relay**.

2.2.4.2 REGIMENTAL AVIATION SQUADRON (**RAS**). The main WETM supporting the ACR collocates with the RAS, providing direct **SWO** and 24-hour forecasting and observing services for air cavalry aircrews. IPB products are based on **UGDFs** valid out to 36 hours, while graphic and alphanumeric products are valid out to 48 hours. The goal is to make tailored weather information available to drive a computerized pilot mission planning system. This would include information on takeoff, recovery, **enroute**, and target area/destination, forward area refueling and rearming points (**FARRPs**) conditions. The goal is for the **WETM** to provide 24-hour observing support to **LZs** using automated airfield weather observations of pressure, temperature, **dew** point, winds, visibility (including **restruictions**), cloud heights and amounts from the surface to 5,000 feet, and current weather conditions, and to relay data to the RAS WETM.

2.2.5 SEPARATE BRIGADES (SEP BDE). The Army has heavy (armor/mechanized) and light separate brigades. The primary missions of separate brigades are reinforcement, deep operations, rear area security, and task force operations for specified missions. Each separate brigade has a dedicated **WETM**, providing direct weather support (**SWO** and 24-hour forecasting and observing) at the brigade TOC. The services and products provided closely parallel that given to a division **DTOC**, except that the brigade has no aviation, the brigade area of influence is smaller, forecast time periods are shorter, and emphasis is on the direct fire battle.

2.2.6 **SPECIAL OPERATIONS FORCES (SOF)**. Army special operations

forces (ARSOF) are likely to be employed on politically sensitive, high-risk missions. These ARSOF missions are often joint or combined and conducted worldwide, through all types of conflict. ARSOF WETMs need to be trained and equipped **similarly** to the Army ARSOF units they support and may require attendance at Army training schools. Because great distances typically separate ARSOF units, their WETMs require special satellite or alternative communication links to relay required basic weather information for the preparation of operational forecasts and IPB planning. Forecast information and required duration are listed in Table 2.1 for the ARSOF units. WETMs support ARSOF units as follows:

2.2.6.1 SPECIAL FORCES GROUP. When deployed, the C2 group headquarters element is located at the special forces operations base (SFOB). The SFOB receives direct **SWO** and 24-hour forecasting and limited hours observing support.

2.2.6.2 FORWARD OPERATING BASE (FOB). Each SFOB controls up to three battalions located at **FOBs**. **FOBs** are normally composed of **C2** elements from the special forces battalion. Each battalion receives 24-hour forecasting and limited hours observing support.

2.2.6.3 SPECIAL OPERATIONS AVIATION REGIMENT. This regiment has rotary wing aircraft that provide lift and fire support to the ARSOF ground units. The regiment receives **SWO** and 24-hour forecasting and observing support.

2.2.6.4 RANGER REGIMENT. The ranger regiment is a specially trained light infantry force. Direct weather support to a ranger regiment consists of **SWO**, 24-hour forecasting, and limited hours observing support.

2.3 OBSERVATIONS. Air Force **WETMs** will take observations using Air Force-provided weather equipment. The goal is to use automated observations wherever possible. Observations are relayed to the nearest **SWO** via Army-provided communications. The Army is responsible for taking and relaying observations in forward areas to support Army weapon systems. Brigade and battalion intelligence staffs will continue to take observations as directed under the Forward Area **Limited** Observing Program (FALOP) through the mid 1990s. After that timeframe, observations taken by the Army will be automated to meet more stringent time and spatial density requirements to support smart munitions and high tech weapon systems. The automated **observing** system is planned to move rapidly with a highly mobile **force**. The system will measure pressure, temperature, dewpoint, wind

speed and direction, soil moisture, and the amount of night illumination. Cloud height and visibility sensors may be added when used in areas where active sensors will not endanger force positions. It is expected to be mounted on brigade and battalion S2 vehicles or be set up separately to report automatically by radio or direct linkage in the Army tactical communication system to the nearest WETM. In some situations the automated observing systems may be placed at key locations and left unattended. The automated observation rate is expected to be as often as every 30 minutes to provide the needed density of observations for Army weather forecast requirements. Algorithms resident on the WETM processor will use digital terrain data bases to infer current conditions for short distances out from the most forward Army observation into enemy territory. The Army provides upper air measuring capabilities to support Army artillery needs. In addition, the Army's UAV will measure temperature, pressure, humidity, wind speed and direction at flight level and below. These measurements will be transmitted from the UAV ground control facility to the nearest USAF WETM. Observations from Army systems at each echelon and weather measurements from Air Force systems will be forwarded to higher echelons. These data, when combined with meteorological satellite data (to include DMSP mission sensor data), will provide a more complete picture of atmospheric conditions in the battle area. This will improve the accuracy of weather forecast products provided by WETMs at each echelon to commanders and staff for mission planning and execution.

2.4 FORECASTS. Using all available theater observations, Air Force WETMs with a forecasting mission will produce forecast information tailored for Army tactical decision making. To augment the centralized weather information, received initially from AFGWC and then from the TWC, the EAC Main WETM will prepare and disseminate a tactical operations area forecast (TOAF) to all subordinate echelons. The TOAF is an alphanumeric forecast bulletin focusing on the corps area of interest. In a multiple corps theater, the TOAF product encompasses the combined areas of interest of the individual corps. The product provides sufficient detail to be used as a stand-alone product when rapid movement or other problems preclude a WETM from establishing connectivity to receive centralized databases from AFGWC and/or the TWC. In a single corps combat operation, there may be an EAC, and TOAF production responsibility may transfer to the corps main WETM.

Forecasting WETMs will have an automated system with a battlefield forecast model (BFM) that will fuse observations (e.g., surface, upper air, meteorological satellite, UAV, AFGWC and/or TWC data, and digital terrain data to produce gridded weather data bases at resolutions sufficient to accurately characterize battlefield and target area weather. USAF WETMs

will operate the automated system and BFM to produce tailored short-range forecasts at spatial and temporal resolutions required for the supported echelon. Weather decision **informati** will be in the form of tailored computer displays, data, and/or alphanumeric messages in specialized formats. WETMs will use the forecast products listed in Table 2.1 to provide tailored products to meet operational users' requirements. **TDAs** are a specific class of tailored products which provide decision information on the employment or projected use of systems and tactics, both for friendly and threat operations. Weather **TDAs** can be subdivided into two categories; **EOTDAs** and **CTDAs**. While both are based on the known effects of weather-on Army systems and tactics, EOTDAs provide specific data on how the environment will affect the acquisition and lock-on range of precision guided weapon systems and the utility of night vision devices. **CTDAs** focus on battlefield weather impacts on tactics and other equipment and systems. **TDAs** provide a precise weather input to a wide variety of combat tactics and support decision algorithms which are run on Army C2 systems, such as the Maneuver Control System.

2.4.1 EAC AND CORPS FORECAST REQUIREMENTS. The EAC and corps WETMs support both combat and support planning, along with execution monitoring missions at their respective units. While **UGDFs** are important to the planning process, particularly the IPP process at EAC and corps levels, many of the weather support requirements at these echelons may be satisfied by theater-wide vector graphic and alphanumeric forecast bulletins valid out to 10 days.

2.4.2 ECHELONS BELOW CORPS FORECAST REQUIREMENTS. WETMs providing weather information to units fighting the direct fire battle (e.g., maneuver brigade, aviation brigade, separate brigade, ACR) require the highest resolution forecast products available from **AFGWC** and/or the TWC. These WETMs then must tailor the forecast products with respect to time and location to provide the commander and staff with the precise information needed to execute **TDAs**. Operational commanders also use their knowledge of weather critical values to determine if an observed or forecast weather element will impact a planned course of action, and to make **adjustments** as necessary to their plans.

2.5 CENTRALIZED WEATHER SUPPORT. As described for theater air operations in Part I, Section 3, Army centralized weather support needs are satisfied by **AFGWC** at Offutt **AFB** NE until the in-theater TWC is activated. Table 2.2 identifies the areal and vertical extent of the TWC products which ECB WETMs need to perform their assigned missions.

2.5.1 AFGWC. The amount and type of data provided from AFGWC to the Army support WETMs will depend on the communications architecture which the theater Army component implements, but at a minimum Army support WETMs will receive UGDFs, alphanumeric, formatted binary data, and vector graphics products to allow the WETMs to prepare weather decision information for their customers. The **Army** component commander's **SWO** will coordinate the flow of observations taken by Army support **WETMs**, **Army** FALOP observers, and Army artillery meteorological (ARTYMET) teams and the flow of forecasts from the theater to AFGWC (and to the TWC when activated). Accurate and consistent weather decision information is based on receipt of all theater weather observation and forecast data at AFGWC and **the** TWC when activated. **AFGWC** will continue to provide tailored weather information for those regions outside of the **TWC's** area of responsibility (e.g., Ports of Embarkation (**POEs**)) for use by forces supporting or conducting combat operations.

2.5.2 **TWC**. The in-theater TWC may use existing in-theater resources (e.g. European Forecast Unit, Korean Forecast Unit, etc.) or may require deployment of all necessary hardware and personnel. Once the in-theater TWC becomes operational, it will develop forecast guidance products for all components to use. The TWC will provide theater and corps area UGDFs from the mesoscale forecast model output which Army support WETMs will use to support combat planning and execution activities. The TWC produces and transmits forecast UGDFs to satisfy the requirements of two distinct users: **EAC WETMs** and **ECB WETMs**. **Forecast** UGDFs for the **EAC WETMs** cover the entire theater, while those for **ECB WETMs** cover an **area** generally no larger than **250km by 400km** (roughly **150nm x 240nm**). If there is more than one corps in the theater, the TWC must produce **a** second **ECB** forecast UGDF package to meet that corps' unique area of interest. Vector graphic products, along with alphanumeric data and products, will cover the entire theater and will be provided to both **EAC WETMs** and **ECB WETMs**.

2.6 COMMUNICATIONS. Initially, Army WETMs will directly receive broadcasts of **larger** areal coverage, lower resolution UGDFs, vector graphics, formatted binary, and alphanumeric data from AFGWC. The desired communications methodology is for WETMs at all echelons to receive the broadcasts simultaneously via reliable, high-speed, and high-capacity systems. The relay of theater UGDF databases from **WETM to WETM, through the Army echelons**, is too time consuming to be feasible. To augment direct receipt of these products, **AFGWC-produced** vector graphics and alphanumeric data can be transmitted via a secondary HF broadcast (e.g., HFRB). These HF broadcasts also serve as a back-up source for weather information whenever WETMs have been on-the-move and routine transmissions were not received, or in

those instances when the communications linkage to **AFGWC** and/or the TWC has yet to be established. After the in-theater TWC is activated as the primary source for weather products, the ideal communications structure is to broadcast **TWC-produced** weather products to all deployed WETMs simultaneously, rather than through the echelons. Army support WETMs will also have the capability of voice, alphanumerics, and facsimile transmissions to other WETMs through the Army's area communications system, the Mobile Subscriber Equipment (MSE). At each **WETM** with a forecasting mission, the MSE basis of issue plan will place two digital nonsecure telephones, one communications terminal (a computer which uses a phone line for electronic mail), and one lightweight **digital** facsimile (a tactical telecopier which uses a phone line). Each WETM will also have a Single-Channel Ground and Airborne Radio System (SINCGARS) radio. These FM radios will be used for relaying weather information between WETMs and for communicating with aircraft. The Army weather support data flow concept is shown in Figures 2.1, 2.2, and 2.3.

TABLE 2.1 WEATHER REQUIREMENTS

(T = Produced by TWC; E = Produced by EAC WETM; C = Produced by ECB WETM; **Climatology** is produced by the USAF Environmental Technical Applications Center)

a. Echelon above Corps Level (Force Planning)

- 0-96 hr forecast (planning forecasts to 10 days) (T)
 - Cloud cover amount, base height (T)
 - Surface visibility and weather (including precipitation types and amounts) (T)
 - Weather hazards (to include aviation hazards) (T)
 - Upper air wind and temperature fields (e.g., 1000 mb, 925 mb, 850 mb, 700 mb, 500 mb) (T)
 - Relative humidity/moisture fields (surface-10,000 ft) (T)
 - Planning forecasts for area of influence (E)
 - Synoptic discussion (plain language forecasts) (T)
 - General favorable/marginal/unfavorable conventional weather forecasts using customer provided thresholds (E)
- 0-48 hr forecasts
 - UGDFs (T)
- 0-24 hr forecasts
 - Terminal aerodrome forecasts (TAFs) for EAC airfields (E)
 - Execution forecasts for area of influence (E)
 - Wind profiles to tropopause+ (T)
 - Weather advisories/warnings (E)
- 0-12 hr forecasts
 - Nuclear Biological and Chemical (NBC) fallout winds surface to 30,000 m in 2,000 m increments (T)
- Meteorological Satellite (METSAT) imagery covering the Area of Interest (T/E)
- Climatology

b. Corps Level (Combat Planning)

- 0-96 hr forecast (planning forecasts to 10 days) (T)
 - Cloud cover amount, base height (T)
 - Surface visibility and weather (including precipitation types and amounts) (T)
 - Weather hazards (to include aviation hazards) (T)
 - Upper air wind and temperature fields (e.g., 1000 mb, 925 mb, 850 mb, 700 mb, 500 mb) (T)
 - Planning forecasts for area of influence (E)
 - Synoptic discussion (plain language forecasts) (T)
- 0-72 hr forecast
 - General favorable/marginal/unfavorable conventional weather forecasts using customer provided thresholds (C)
 - Relative humidity/moisture fields (surface-10,000 ft) (T)
- 0-36 hr forecasts
 - EOTDAs (weapon specific acquisition and lock-on ranges) (C)
 - UGDFs (T)
- 0-24 hr forecasts

- **TAFs** for **AEB** operations from Corps airfields (C)
 - Execution forecasts for area of influence (C)
 - Wind profiles to tropopause+ (T)
 - Weather advisories/warnings (C)
 - 0-12 hr forecasts
 - NBC fallout winds surface to 30,000 m in 2,000 m increments (T)
 - **METSAT** imagery covering the Area of Interest (C)
 - Climatology
- c. Division Level (Combat Execution)
- 0-72 hr forecast (planning forecasts to 10 days) (T)
 - Cloud cover **amount**, base height (T)
 - Surface visibility and weather (including precipitation types and amounts) (T)
 - Weather hazards (to include aviation hazards) (T)
 - Upper air wind and temperature fields (e.g., 1000 mb, 925 mb, 850 mb, 700 **mb**, 500 mb) (T)
 - Planning forecasts for area of influence (E)
 - Synoptic discussion (plain language forecasts) (T)
 - 0-48 hr forecasts
 - General favorable/marginal/unfavorable conventional weather forecasts using customer provided thresholds (C)
 - Relative humidity/moisture fields (surface-10,000 ft) (T)
 - 0-36 hr forecasts
 - **EOTDAs** (weapon specific acquisition and lock-on **ranges**) (C)
 - **UGDFs** (C)
 - 0-24 hr forecasts
 - **TAFs** for Division LZ (C)
 - Execution forecasts for area of influence (C)
 - Wind profiles to tropopause+ (T)
 - Weather advisories/warnings (C)
 - 0-12 hr forecasts
 - NBC fallout winds surface to 30,000 m in 2,000 m increments (T)
 - **METSAT** imagery covering the **Area** of Interest (C)
 - Climatology
- d. Brigade Level* (Execution Tactics)
- 0-48 hr forecast (planning forecasts to 10 days) (T)
 - Cloud cover amount, base height (T)
 - Surface visibility and weather (including precipitation types and amounts) (T)
 - Weather hazards (to include aviation hazards) (T)
 - Upper air wind and temperature fields (e.g., 1000 mb, 925 mb, 850 mb, 700 mb, 500 **mb**) (T)
 - Planning forecasts for area of influence (E)
 - Synoptic discussion (plain language forecasts) (T)
 - 0-36 hr forecasts
 - General favorable/marginal/unfavorable conventional

- weather forecasts using customer provided thresholds (C)
- EOTDAs (weapon specific acquisition and lock-on ranges) (C)
- UGDFs (T)
- 0-24 hr forecasts
 - TAFs for CAB/RAS LZs and FARRPS (C)
 - Execution forecasts for area of influence (C)
 - Wind profiles to tropopause+ (T)
 - Weather advisories/warnings (C)
 - Relative humidity/moisture fields (surface-10,000 ft) (T)
- METSAT imagery covering the Area of Interest (C)
- Climatology

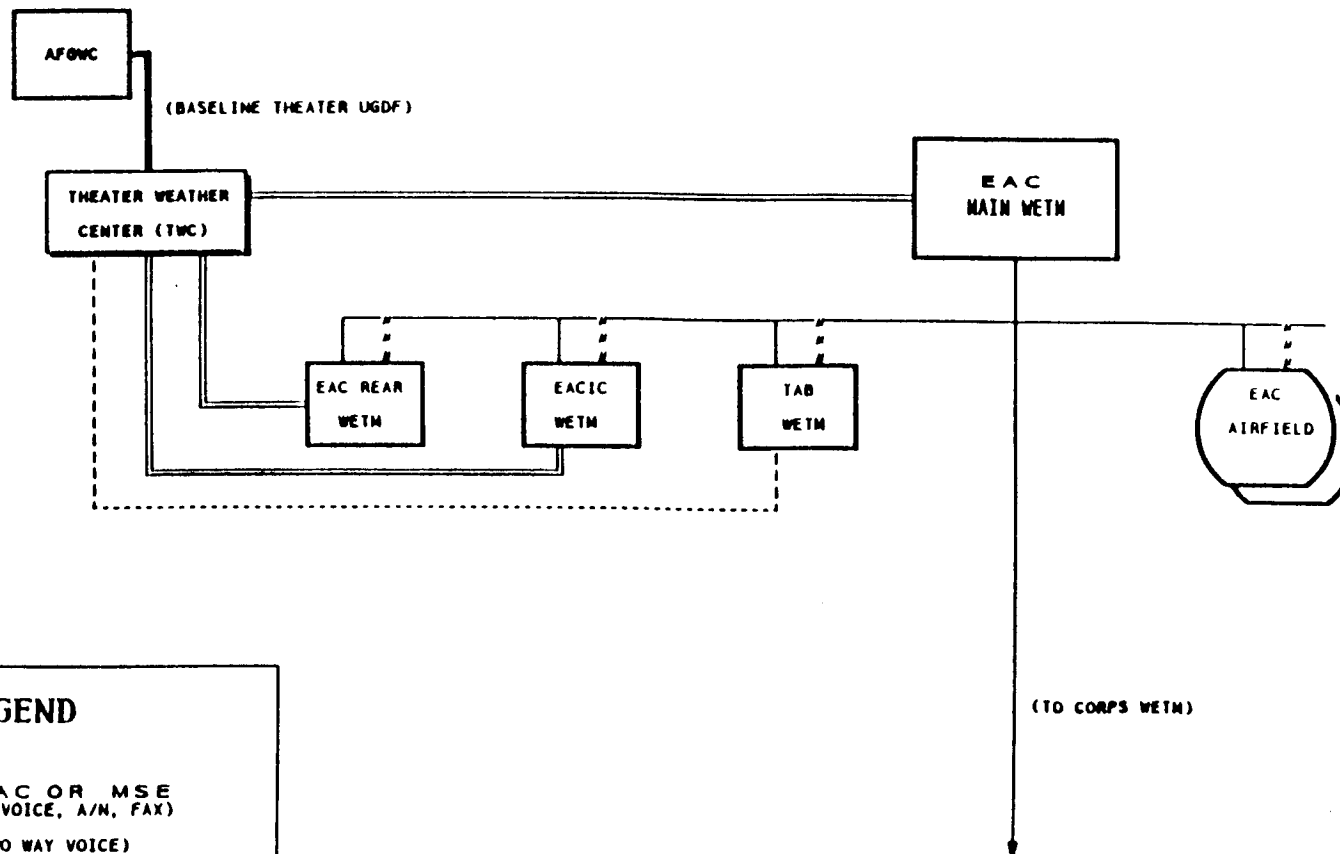
* Brigade level includes Aviation Brigades, Separate Brigades, Armored Cavalry Regiments, and Special Operations Forces.

+ Profiles from surface to 5,000 ft in 500 ft increments, from 5,000 to 20,000 ft in 1,000 ft increments, and then from 20,000 ft to the tropopause in 5,000 ft increments.

TABLE 2.2 TWC PRODUCT COVERAGE FOR ECHELONS CORPS AND BELOW

	AREA	ALTITUDE
UGDFs	Corps Area of Interest (250km x 400km)	SFC-500mb
Vector Graphics	Theater	SFC-Tropopause
Alphanumeric products (Discussion bulletins, wind profiles, observations, terminal/area forecasts, etc.)	Theater	SFC-Tropopause

ECHELON ABOVE CORPS Weather Data Flow



LEGEND

- TRITAC OR MSE
(TWO WAY VOICE, A/M, FAX)
- ~~~~~ FM (TWO WAY VOICE)
- ===== EAC DATA PACKAGE
- ECB DATA PACKAGE
- WETM WITH AUTOMATION
(Can Also Receive From Secondary
HF Broadcasts, e.g., HFRB)
- WETM W/O AUTOMATION

ECHELON CORPS and BELOW Weather Data Flow

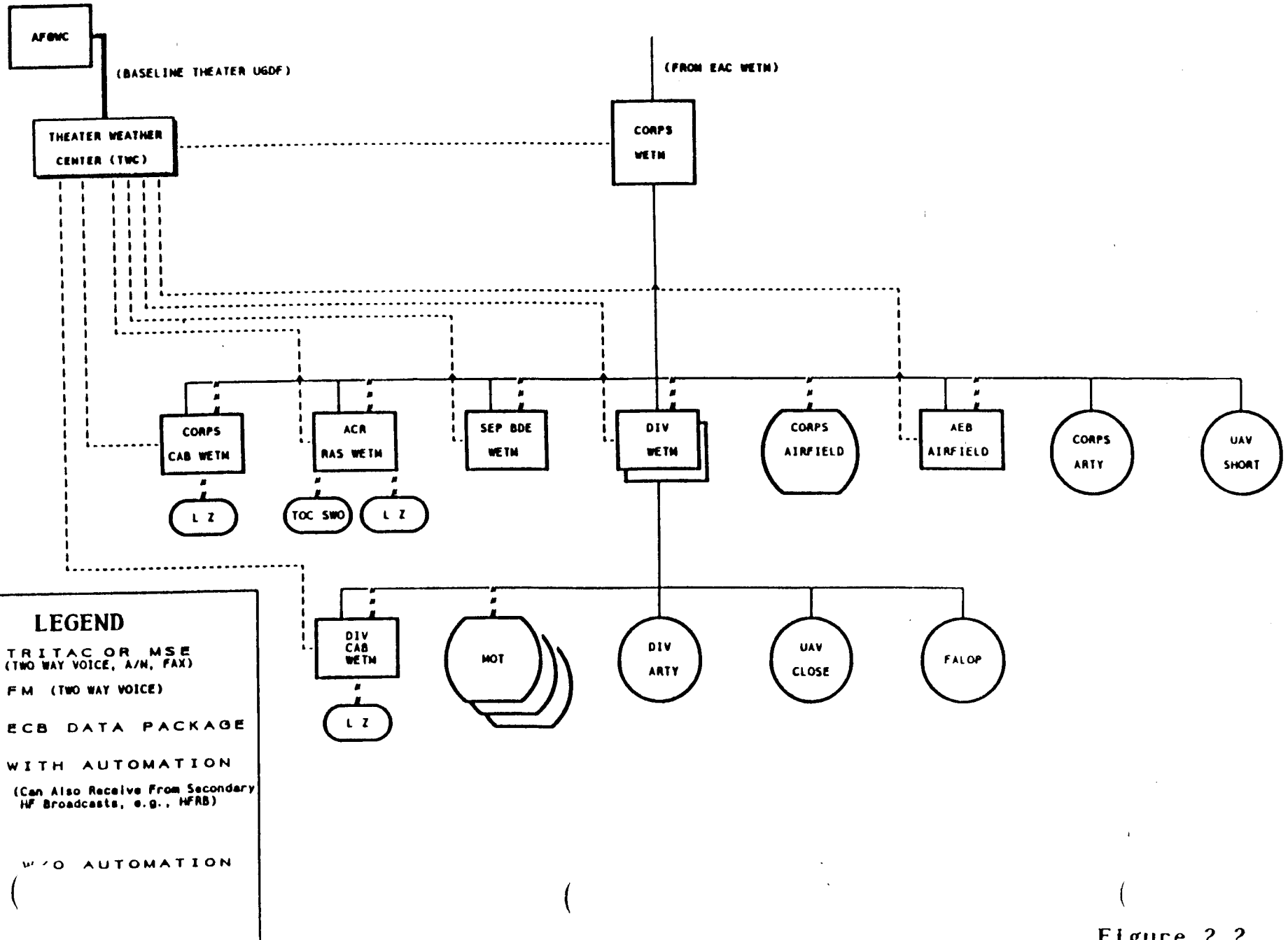
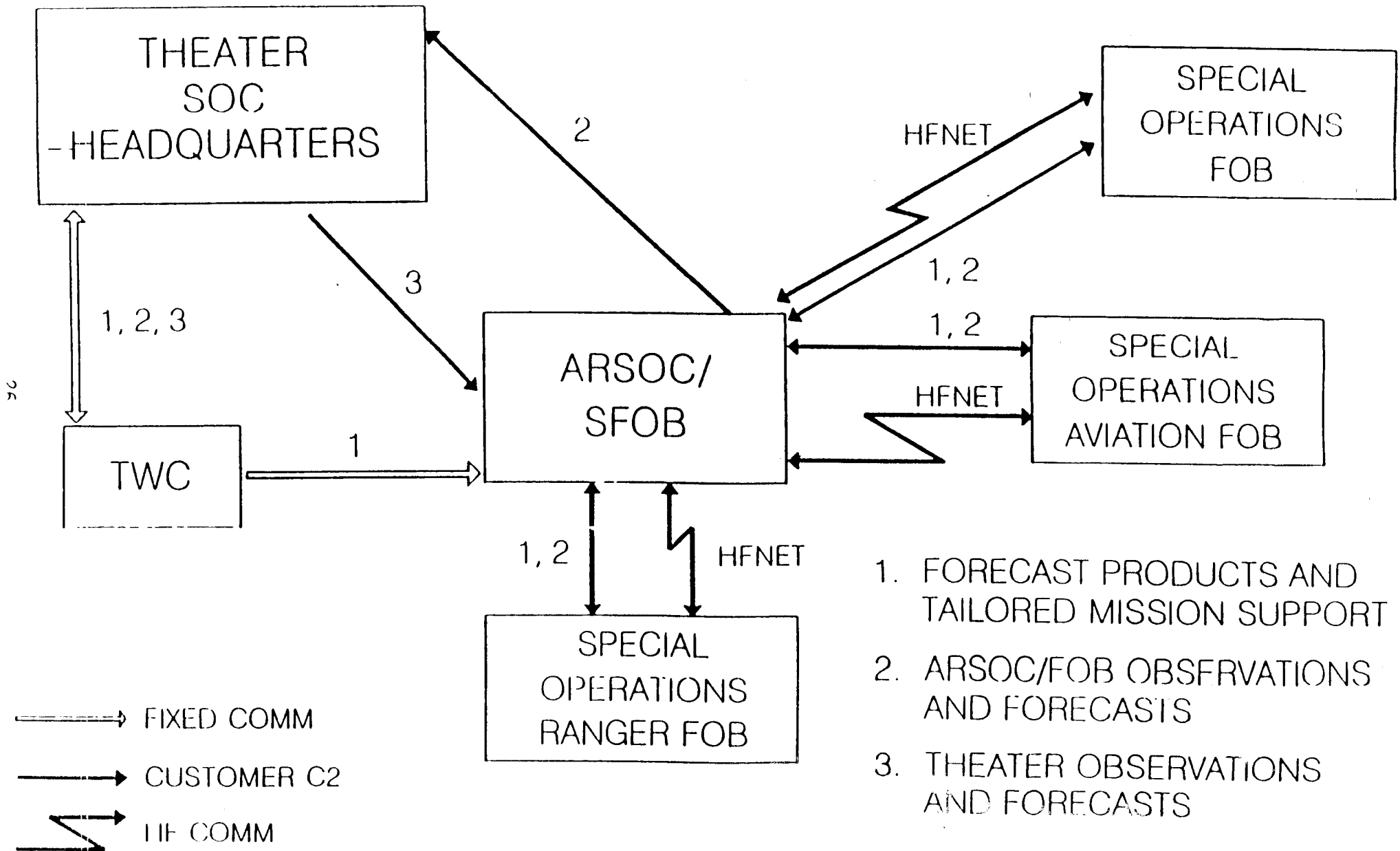


Figure 2.2

ARSOF DATA FLOW



SECTION 3. ARMY SPECIAL OPERATIONS FORCES (ARSOF) STAND-ALONE OPERATIONS

3.3.1 PREDEPLOYMENT ENVIRONMENT. ARSOF missions extend throughout the operational continuum from peacetime competition through war and into post-hostilities. Weather support to SOF throughout this spectrum requires SOWTs to be able to deploy with little warning capable of supporting the entire ARSOF mission continuum. In some situations, Army Special Forces are deployed as stand-alone units; in others, they are integrated with Theater Army forces. During peacetime competition, weather teams may support multiple foreign internal defense (FID) missions which occur simultaneously throughout the world. FID missions offer the opportunity to collect weather information (for example, daily maximum and minimum temperatures and precipitation to build better climatology) and/or weather support information (for example, site surveys to determine host nation weather support capabilities). Army Rangers and Special Operations Aviation, as well as Special Forces, must be able to rapidly deploy to anywhere in the world to execute tasked missions. Responsive weather support for such missions requires a highly trained, versatile weather support capability, with SOWTs prepared to deploy immediately with all equipment required to conduct extended operations.

3.3.1.1 IN-GARRISON CAPABILITIES. Training to develop and maintain these capabilities is one of the missions of the SOWTs. These teams need their area of responsibility database available in real time while in garrison to accomplish training and to provide planning support to their supported ARSOF unit. The database should include area-specific DMSP imagery and mission sensor data; geostationary METSAT imagery; UGDFs; climatological databases from ETAC; and analysis and forecast fields for the area of interest.

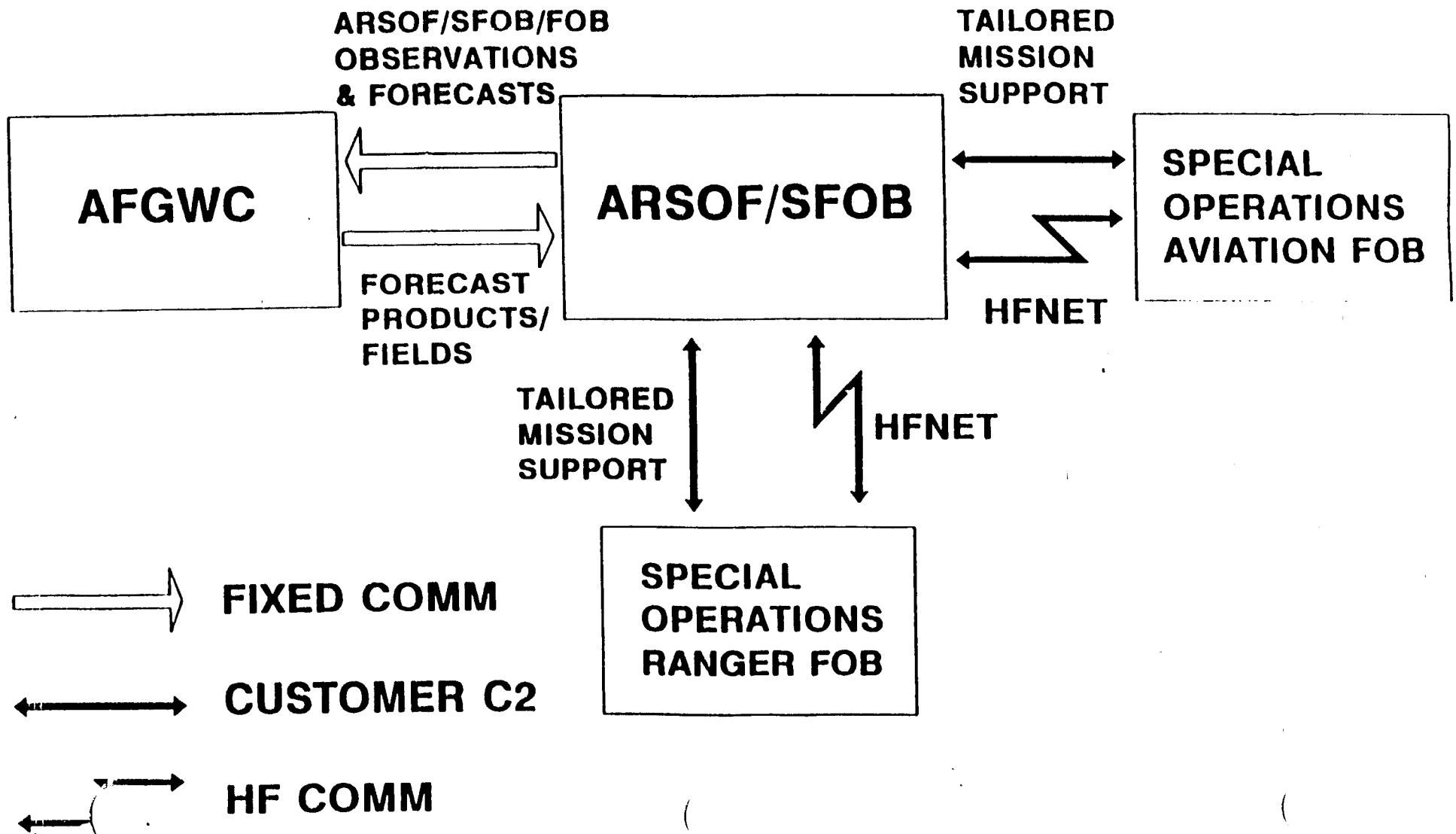
3.3.2 DEPLOYMENT. During deployment, the weather team needs the capability to maintain currency of its database. Weather support to the commander must not be interrupted during layovers at staging bases. For example, small, lightweight and operationally flexible communications systems can be taken aboard the aircraft and used at enroute stops to update databases to permit the SWO to keep the commander abreast of any changes in area of interest weather conditions during deployment.

3.3.3 EMPLOYMENT. Command and control of the ARSOF is exercised at the Special Forces Operating Base (SFOB). The SFOB and Ranger TOC receive direct 24-hour SWO and forecasting support with limited observing support. The SFOB controls lower echelon unit.

at Forward Operating Bases (FOBs). Because of the great distances which can exist between the SFOB and FOBs, remote weather support is not usually feasible; therefore, each FOB receives 24-hour forecasting and limited observing support. The **ARSOF/SFOB** (the SFOB may function as the ARSOF) weather team will depend upon weather information from **AFGWC**, or the existing TWC, to provide for its initial forecasting and weather support capability. In situations when more personnel and equipment are deployed, the weather team's capabilities will allow them to reduce dependence on AFGWC, and/or the TWC, forecast products, if required. The weather team will collect, process, and analyze data and make detailed forecasts for the SOF area of operations using all available weather information. To provide the most capable weather support, the same databases the weather team used in the **predeployment** environment (paragraph 3.3.1.1), should be available in their employment operations. (Employment operations with reduced data/fields from those available during training activities will result in degraded weather support.) Additional indigenous data may be available (for example, local national weather observations disseminated via indigenous **landline** circuits). Additional capabilities which may become available (such as indigenous weather radar data) will enhance weather support. Specific mission employment scenarios will determine the **SWO's** ability to incorporate such capabilities into the decision making process.

3.3.4 COMMUNICATIONS. Weather information is perishable. Large amounts of weather data covering the specific area of **interest** must be acquired, analyzed, and disseminated quickly. Since efficient communications are essential, supported commanders must ensure they provide the communications support needed for **timely** exchange of weather information. Figure 3.1 shows a typical ARSOF stand-alone weather data communications flow diagram. This figure assumes connectivity to AFGWC (or TWC) is possible. In some stand-alone operations, continuous connectivity with AFGWC may not be possible. Communications for ARSOF weather teams are provided by the unit to which they are attached. Long-term employment operations in a theater may permit connectivity to the main **ARSOF** operational headquarters to allow teams to receive AFGWC products.

ARSOF STAND-ALONE CAPABILITY



ACRONYMS / ABBREVIATIONS

ACR	Armored Cavalry Regiment
AEB	Aerial Exploitation Battalion
AFGWC	Air Force Global Weather Central
ARSOC	Army Special Operations Command
ARSOF	Army Special Operations Forces
ARTY	Artillery
ARTYMET	Artillery Meteorological
ATCCS	Automated Tactical Command and Control System
BFM	Battlefield Forecast Model
c2	Command and Control
CAB	Combat Aviation Brigade
COMMZ	Communications Zone
CONOPS	Concept of Operations
CONUS	Continental United States
CTDA	Conventional Tactical Decision Aid
CTOC	Corps Tactical Operations Center
DIV	Division
DMSP	Defense Meteorological Satellite Program
DTOC	Division Tactical Operations Center
	Echelons Above Corps
	Echelons Above Corps Intelligence Center
	Echelons Corps and Below
	Electro Optical Tactical Decision Aid
	Environmental Technical Applications Center
	Forward Area Limited Observing Program
	Forward Area Refueling and Rearming Point
	Foreign Internal Defense
	Frequency Modulated
	Forward Operating Base
FT	Feet
G2/S2	Asst Chief of Staff for Intelligence/Army Intelligence Officer
	High Frequency
	High Frequency Radio Broadcast
	Intelligence, Electronic Warfare
	Intelligence Preparation of the Battlefield
LZ	Landing Zone
	Meters
	Millibars
METSAT	Meteorological Satellite
	Military Intelligence
	Mobile Observing Team
	Mobile Subscriber Equipment
NDI	Nondevelopmental Items
	Port of Embarkation
R A S	Regimental Aviation Squadron
RTOC	Regimental Tactical Operations Center
SEP BDE	Separate Brigade
SFC	Surface

SFOB	Special Forces Operations Base
SINCGARS	Single-Channel Ground and Airborne Radio System
SOC	Special Operations Command
SOF	Special Operations Forces
SOWT	Special Operations Weather Team
SWO	Staff Weather Officer
TAB	Theater Aviation Brigade
TDA	Tactical Decision Aid
TOAF	Tactical Operations Area Forecast
TOC	Tactical Operations Center
TOE	Tables of Organization and Equipment
TRADOC	Training and Doctrine Command
TRITAC	Tri-Service Tactical Communications
TWC	Theater Weather Center
UAV	Unmanned Air Vehicle
UGDF	Uniform Gridded Data Fields
WETM	Weather Team